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THE WHAT HOW AND WHY OF CHURCH BUILDING

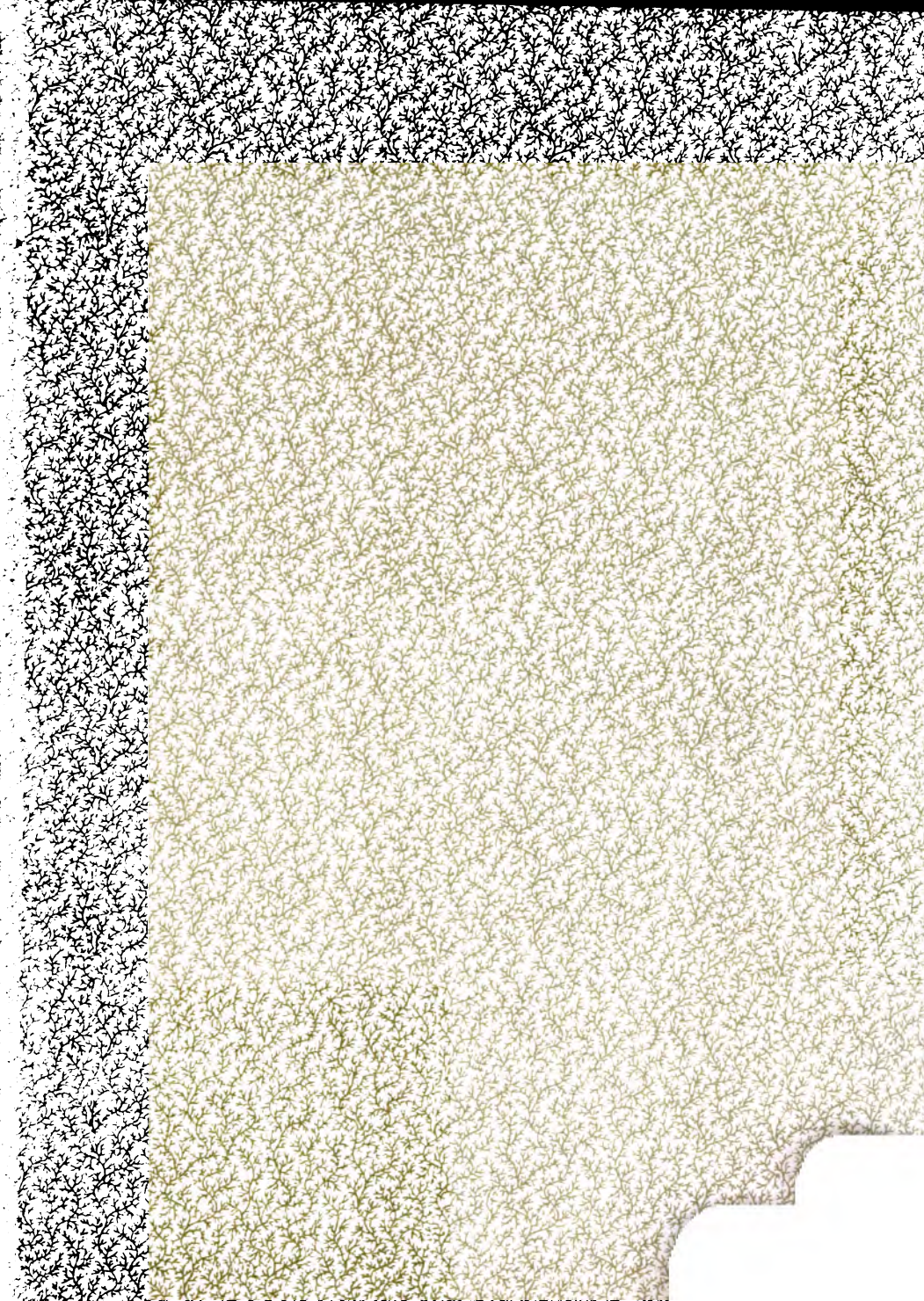
Joseph Gudnuf
EX DONO
A Book from his Library

Harvard University
Frances Loeb Library
Graduate School of Design

the gift of

Kenneth J. Conant

171



G. W. Kramer, Architect.

ST. JOHN'S M. E. CHURCH, NEW ROCHELLE, N. Y.

G. W. Kramer, Architect.

ELM PARK CHURCH, SCRANTON, PA.

THE WHAT HOW AND WHY OF CHURCH BUILDING

"COME NOW LET US REASON TOGETHER"

GEO·W·KRAMER·F·A·I·A

PORCH, CHRIST CHURCH, PITTSBURG, PA.

NEW-YORK-1897

HARVARD UNIVERSITY

FEB 21 1985

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G. W. Kramer, Architect.

CHURCH, ROCHESTER, N. Y.

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Yours truly, Geo. W. Kramer.

To those whose co-operation, interest,
encouragement and sympathy
has made possible this
Record of the
Development of the Modern Church,
this work is respectfully dedicated
by the author.

I DREAMED · THAT STONE BY STONE I REARED A SACRED FANE,
A TEMPLE, NEITHER PAGOD, MOSQUE, NOR CHURCH,
BUT LOFTIER SIMPLER, ALWAYS OPEN DOORED
TO EVERY BREATH FROM HEAVEN; AND TRUTH AND PEACE
AND LOVE AND JUSTICE CAME AND DWELT THEREIN · TENNYSON-

PREFACE.

IT has been the accident of my life to have been intimately connected with the development of the modern Church and Sunday School buildings of America.

While I do not claim this as a merit, there may be Providence in it, as by this early association with the master minds and workers I became familiar with their ideas, desires and plans concerning what the work of the Church and Sunday School should be, and the incapacity of the then existing buildings for the advantageous adoption of these plans for increased usefulness, indicating the necessity for better or different accommodations, to make the realization of these desires possible.

Thus being cognizant of the causes and demands which have been instrumental in the evolution, and familiar with the various experiments—speculative and theoretical—which have been made in the development, I also became familiar with the essentials and requirements, and with the various methods and plans for meeting them, and their practicability and advantage under the various conditions when materialized. Thus, in sympathy by nature and association with the movement almost from its first inception, I have been largely influenced by the same motives.

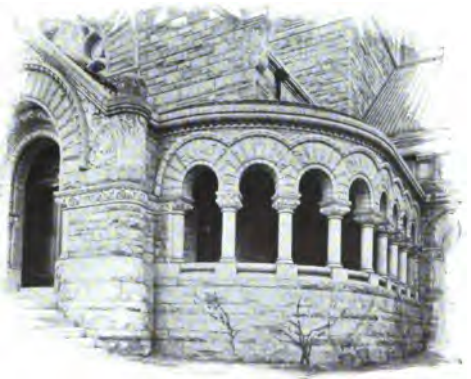
Others have felt the same impulses, and if consequently we arrive at different conclusions, it is owing more to the various sources from which the information is derived than to differences in the individuals who announce it. The similarity of results however, demonstrates the fact that the causes, demands and requirements are similar and of a definite

G. W. Kramer, Architect.

INTERIOR, BAPTIST TEMPLE, BROOKLYN, N. Y.

G. W. Kramer, Architect.
INTERIOR, CHRIST CHURCH, PITTSBURG, PA.

character; everything indicates that the forms and systems have passed the experimental stage and are largely adopted as standards. I have had the above facts very emphatically impressed on my mind by those whose opinions I value, who have also endeavored to convince me that it is my duty to give to the public the benefit of my experience, and thus materially advance the cause. It is therefore with many misgivings of my ability to do the subject justice, that I now give the results to the public.



CLOISTER, CHRIST CHURCH, PITTSBURG, PA.

G. W. Kramer, Architect.

UNION M. E. CHURCH, 48TH ST., NEAR BROADWAY, NEW YORK.

The questions involved may be considered from two distinct points of view — *statically*, as a thing existing without reference to the manner in which it was invented or developed; or *historically*, tracing every form from its origin in the progress of time.

The first method is technical, demanding familiarity with, and knowledge of, the subject, the general lack of which is the occasion of this work; hence, the other, a more popular and more easily followed system has been adopted, which I trust will meet, if not merit, the approval of the public.

November, 1896. GEO. W. KRAMER.

EXPLANATORIUS.

IN the preparation of this work, it has been deemed advisable and of advantage to the text to add illustrations of various plans and designs of churches, chapels and Sunday School buildings which are real exemplifications of the practical application and advantage of the theories involved.

The distinctive fundamental principle or basis of all modern ecclesiastical work is the development and utilization — as auxiliaries — of all the various available influences and latent forces of the church, which have been dormant for ages awaiting the "fullness of time."

G. W. Kramer, Architect.

INTERIOR, UNION M. E. CHURCH, 48TH ST., NEW YORK.

G. W. Kramer, Architect.

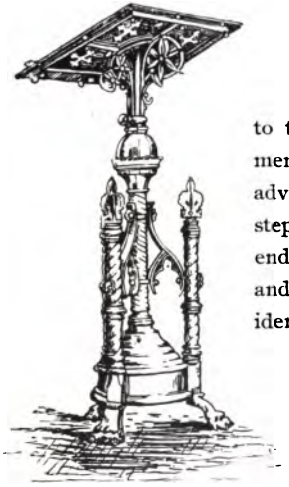
ST. JAMES M. E. CHURCH, KINGSTON, N. Y.

With the Sunday School as an essential part of the modern church-work and service, new forms of buildings are necessitated adapted to the special requirements of this new service. The advantage of combining the work of all the various auxiliaries under the oversight, management and control of the church, naturally suggests a "*Combination*" Church.

The first practical buildings which were especially planned to accommodate these new requirements of the service originated at and were erected in Akron, Ohio, and have proved so efficient and satisfactory in character, that the plans and principles have been adopted as *standards*, and have become well known throughout America and in many foreign

G. W. Kramer, Architect.

FIRST PRESBYTERIAN CHURCH, ASBURY PARK, N. J.



lands as the "AKRON PLAN" and "AKRON SYSTEM."

No work of this character can be considered complete without giving due credit to those under whose influence the new movement was first inaugurated, and who, by their advice and encouragement, have aided its every step; hence, in the concluding chapter, we shall endeavor to give a brief history of the evolution and development of the modern church and those identified with it, leaving to others — or a future time — the full history of the various influences and individuals coöperating, and establish the legitimacy of the modern church by tracing the development of the present type from its orthodox ancestry.

G. W. Kramer, Architect.

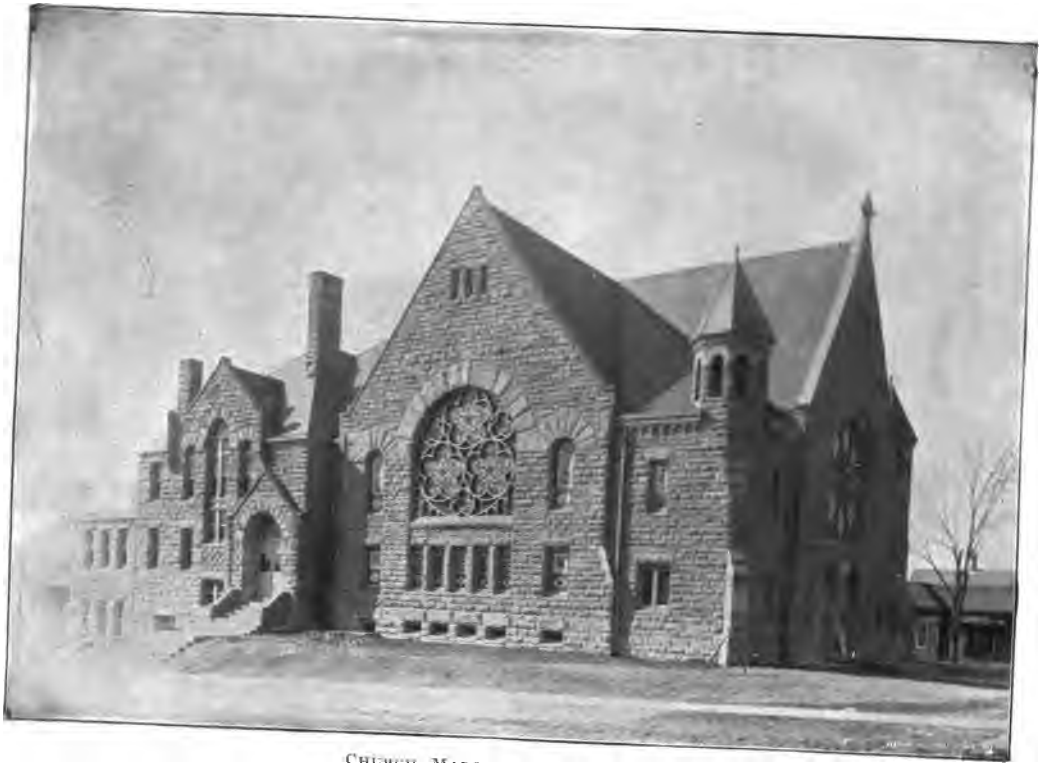
WILLIAMS BRIDGE M. E. CHURCH.

The various cuts introduced represent edifices actually erected, and not imaginative or suggestive sketches; thus the efficiency and sufficiency of the various systems and plans have been thoroughly tested in practice, and the perfect adaptability of the same to the varying conditions and requirements demonstrated in hundreds of instances, not only in one locality, but in nearly every State of the Union, for all the different sects, of every character of material, and in every degree of expense, from the modest chapel costing but a few thousand to the magnificent edifice costing hundreds of thousands.

G. W. Kramer, Architect.

CHURCH, DERBY, CONN.

To those whose interest will induce them to peruse the various subdivisions of this work, we would suggest a careful consideration of the various plans in connection with the subject-matter, as all have been thoroughly tested in actual practice by pastors and congregations, and represent in some form various applications of the principle involved and much of their best thought and suggestion.



CHURCH, MARSHALLTOWN, IOWA. *G. W. Kramer, Architect.*

CONTENTS.

PREFACE

EXPLANATORIUS.

PRELUDE

WHY? PAGE

Object and Mission 18

CHAPTER

I INTRODUCTORY.
Retrospective, Introspective and Prospective 23

II BUSINESS IN CHRISTIANITY.
Proper Steps of Procedure from First Inception 35

III WHAT?
Interior Requirements.—Division and Sub-division . . . . .
System.—Independent or Combination . . . . . .
Exterior.—Character, Style and Environment . . . . . .
Ideal.—The Social or Institutional Church 47

IV HOW?
The Architect.—His Work and Relation to Client 73

V NOW.
The Paper Church.—The First Tangible Form 81

VI PRACTICAL.
Ideality vs. Reality.—The Artists, Artisans and Contractors . . 89

VII ADVISORY.
Honesty vs. Shams.—An Appeal.—Duty 102

VIII SPECIFIC.
The Site, Foundation, Walls, Roof, Construction, Ceilings, Floors, Security and Safety 107

IX ANALYTIC.
Men, Methods and Materials.—Common and Uncommon . . . 123

X ENGINEERING.
Heating and Ventilation.—Sanitary, Electric and Constructive . . 139

XI INHERENT ESSENTIALS.
Acoustics, Lighting, Conveniences, Etc. 166

XII FURNISHING.
Seating, Furniture, Cushions, Carpets and Specialties . . . 176

XIII MUSICAL.
Organs and other Instruments; Choirs, Orchestras, Bells, Clocks, Etc. 186

XIV ESTHETIC AND ARTISTIC.
Memorials, Decorations, Stained Glass and Mosaics. 196

XV SECURITY.
Bonds, Guarantee, Insurance, Etc. 208

XVI SEQUEL. 215

XVII TECHNICAL 234

PRELUDE.

WHY?

OBJECT AND MISSION.

ANY people and things in this world exist without any apparent reason or occasion, which really owe the community an apology for their existence, some coming to meet a demand, others to create one.

Books, like people, have many ways of getting into their places. *This book* comes and seeks its place by a stress of circumstances which could not well be resisted — the immediate circumstances being external. In this day of books, one would scarcely suppose there was a subject not exhausted. There are however oversights, and one is often surprised, on pursuing investigation in special lines, with the poverty of literature of an authentic character, where the supply was supposed to be inexhaustible.

Possibly one of the most remarkable omissions is the absence of any reliable work concerning the modern church, its essentials and possibilities, the best systems, plans, styles, methods and materials in connection with the erection of new, as well as the remodeling of existing edifices. This is a subject of vital importance to the success of a cause dear to a large majority of the population of our country, and essential to the well-being of all.

In speaking of it as the "*Modern Church*," we do not wish to convey the impression of any *new* institution, but the increased facilities and opportunities for usefulness which have come with our advanced civilization and more liberal views regarding the legitimate work of the church, and the church as the *building* rather than the *society*. Recognizing the fact that the church as an association, is altogether different from what it was even a generation ago, and the increase of the work has been so

rapid, by the addition of numerous auxiliaries, that the entire organization has been revolutionized, and the evolution of the modern church edifice from the primitive meeting-house has been so great, to keep pace with the growing demands, that the structures of even a decade past will not serve the needs of the present day.

The church of to-day is an *institution*, and its every requirement must be studied and considered understandingly, for as certainly as a perfectly adapted house is an advantage and help, so certainly will one ill-adapted be a detriment and an actual hindrance to the cause. This fact is generally recognized, and there is in consequence an earnest desire on the part of all interested to secure the best results possible. In considering this subject, however, we must remember that Church Architecture is influenced by the strong lines of demarcation between the different sects. All these things have made their impress, and the influence is one that has been inherited by the present generation, and more or less modifies the present ecclesiastical buildings.

The division and subdivision of the religious communities of this country — of the non-liturgical persuasion — has multiplied the churches and reduced their ability to erect buildings of a *monumental* character. This, coupled with the straightforward utilitarianism which is a characteristic of the more liberal churches of this country, and our national disregard of traditions, has operated to prevent the development of any specific type as the expression of their religious sentiments.

Without traditional or established forms each denomination is endeavoring to adapt its service and organization to the new conditions, and to secure some type or arrangement of building best adapted to advantageously conducting the service and accommodating the various departments and auxiliaries. In the development of this new type there is no reason why there should not be concert of action, as the denominational differences are principally doctrinal.

A careful study of the situation and the various requirements will convince any one that the same *general conditions* are common to all, with only such modifications of detail and arrangement as may be necessary to adapt it to each individual case. Perfect familiarity with the subject and all the conditions is essential to a thorough understanding of the requirements. This cannot be acquired in the study or investigation necessary to one example. The experience of each society is limited to its

own individual case, and, while it may fall to the lot of a large number of pastors to build new churches, those who will be called on to build the second or third will be comparatively few. Human nature dislikes to confess error; the mistakes made are rarely acknowledged; consequently others cannot benefit thereby, and the process of development is slow and not always a step in advance. In each instance some reliable information bearing on the subject — based on experience and familiarity with all the requirements, coupled with such technical and professional knowledge as may be necessary to make the practical application — would be of great value. The absence of any information of this character, coupled with earnest and repeated requests from many of the leading clergy and laity to compile such a work, is our apology for its existence.

When we consider that there are in the United States alone over 150,000 congregations of the non-liturgical denominations, each possessing a house of worship of some character, with a membership of over 15,000,000, and a value of church property of nearly $500,000,000, some idea of the magnitude of the field may be formed. In connection with this, there are nearly 20,000 ritualistic churches, with a membership of 8,000,000 and a value of church property of over $200,000,000; also 130,000 Sunday Schools, with a membership of nearly 10,000,000 scholars, taught by 1,300,000 teachers. Under normal conditions, there are at least 4,000 churches built or remodeled every year in this country.

This is a field second to none other in magnitude or importance, and its influence on the morals of our country is inestimable. It is essential to the work and efficiency of this army that it should be thoroughly equipped with properly designed, arranged and furnished buildings. Fully appreciating the magnitude and importance of the undertaking, we have endeavored to systematically, and as thoroughly as possible, consider the subject in such a way as to best benefit those interested, and provide such information on the subject as may enable them to ascertain what has been done by others, what is advisable, what is essential, what to do and how to do it; entirely from a *practical* standpoint and not from a *sentimental* one, all being largely the result of experience and demonstrated of practical value and advantage in practice, and not untried theories.

If the object for which this is intended is but *partially* realized, we shall have the consciousness of having had some small mission in life.

Numerous works of an ecclesiological character are to be found in the market which treat the subject in a historic, traditional, iconographic or esthetic manner, all, however, written from a different standpoint from ours. Correct from their own point of view, they either antedate or do not recognize the fact that the *Church in America* of to-day is quite a different matter from the *Church of Europe*. While the type of the modern non-ritual church is *developing*, there can be no history, no tradition, no orthodox guide. Eclecticism must prevail, and experience must be the guide. But soon it will crystallize into definite form, and we shall have an accepted enduring type of ecclesiastical building — consistent, economical and beautiful; one that will possess the essential qualities of dignity and repose.

The service of the Episcopal Church, having undergone fewer changes and adopted fewer of the modern innovations, is to some extent an exception and liable to be superior to the non-liturgical denominations in the monumental character, dignity and repose, which have come to be considered ecclesiastical — largely from association. The general arrangement and architectural expression considered ecclesiastical by the Episcopal churches, has generally been found by them so satisfactory and adequate, that we may say it has crystallized and has become historic and traditional. Having thus assumed a definite form, it becomes a science, is taught in the schools, has its literature; and numerous works of accepted authority treating on the history, traditions and essentials of ecclesiology and Christian iconography are obtainable.

A predilection for Gothic forms is a part of this tradition, but the comparative architectural excellence of the Episcopal Church is something apart from the style, as many of the finest examples are *not* Gothic. This adherence to established types has left the designer free to bestow on the proportions and detail an amount of study not possible where one has to invent new types with each design. With the *non-ritual* church, until some specific type shall be adopted, the problem will remain largely one of *invention* rather than of *adaptation*. Everything about modern architectural practice has a tendency to divert attention from the orthodox forms and traditions of architecture. This is essentially a *new world* and *age* both as to *new demands* and *requirements* as well as *new methods*, *construction* and *materials*. And the architect who has been educated in the classic and medieval schools must free himself from the fetters of conservatism, and, dwelling in this new atmosphere, adapt himself to the new conditions and

types. Under these circumstances, it is not to be wondered at that, when people are ready to erect costly church edifices, few men can be found who can embody in their plans and designs the essentials of the Modern Church; the regular practice of modern architecture unfitting the general practitioner for ecclesiastical work, and the modern non-ritual church being without type or precedent. In the case of ritualistic churches, however, there are standard works of reference and established types, so that the practical architect, even if inexperienced in ecclesiological work, can thoroughly inform himself. Practical experience is essential, however, as well as familiarity with the subject, to introduce advantageous details of arrangement or modifications.

The remarkable increase in members and wealth of the various branches of the Protestant Church has permitted the devotion of more money to church building, and puritanical ideas have given way to those more liberal. A vast amount of money is yearly spent in the United States upon costly and elaborate ecclesiastical edifices, clever in arrangement, convenient in plan, luxurious in appointment and decoration, and picturesque in design, many of which are notoriously unfitted for the purpose for which they were intended, thereby crippling the efficiency of the church and becoming monuments of wasted opportunity and sometimes willful ignorance.

The principal cause, however, for this condition is the lack of general information or investigation on the part of those in control as to what the real work and requirements of the church are or should be, and knowledge of what has been or is being done by others towards the development of a type of church designed to meet these requirements in the most advantageous and economical manner. There should be a "campaign of education" in ecclesiastical art and architecture among the more intelligent church people, which would not only *reform the ancient practice on modern lines*, but determine *what those lines should be for modern practice.*

CHAPTER I.

INTRODUCTORY.

RETROSPECTIVE, INTROSPECTIVE AND PROSPECTIVE.

HE origin of the House of Worship is shrouded in the mists of antiquity. Every nation of which history or tradition informs us had their temples. Many were models of splendor and beauty, not only in the age contemporary with them, but gigantic and impressive even in their ruins, as compared with modern works.

Man — naturally religious — stood in awe of the mighty forces of nature beyond his understanding and control, erected altars in his desire to propitiate them by worship and sacrifice. Thus "The groves were God's first temples." Veneration and regard for the Deity demanded some visible abode, which was first supplied by the Tabernacle.

With the change of habits, from a wandering, nomadic life to a more permanent one, the tent was exchanged for the dwelling. This same veneration demanded a change of a like character for the Deity. Thus the Temple primarily was not a *place of worship*, but the *abode of the Deity*.

It is remarkable, that from Adam to David there is no record of any house or temple erected to the worship of the true God. Altars were built for sacrifice, and the Tabernacle for the Ark; but if there was any building, the historian — sacred or profane — has left us in practical ignorance of the fact. It was left for David to conceive and Solomon to build the first temple to the true God. The Jewish Temple was for the whole nation and its grandeur and beauty were the pride of the Jewish people and the admiration of the world.

There has always been a sacredness and veneration for the house of worship, even among the pagan nations, and those who desecrated or destroyed them have received the execration of mankind, thus illustrating the natural reverence for any place

devoted to worship. In many instances refuge in the Temple was beyond the pale of the law.

The temples however, were of a dark, mysterious character; unsuitable and unfitted for the services in which the *people* were to participate, with the advance of civilization and enlightenment. Gradually synagogues were erected in the different cities for instruction and worship, and at the advent of Christianity were common among the Jews.

The *spirit* of worship has been the same through the long ages. External methods, however, have changed. Before the captivity, the exercises included nothing in the way of preaching. Even the reading of the law seems to have formed no part. Later, we find that the priests took with them copies of the law, reading and explaining it to the people in their journeys through the land. As there was but one Temple, or House of God, for the nation, there was a demand for other places of worship for the benefit of those who could not take part in the worship of the Temple. This gave rise to the synagogue, representing in miniature the Temple. This system or method of worship became so firmly engrafted in the Jewish ritual, that in the period preceding the advent of Christianity, synagogues were to be found in all the towns and even the villages, where the people met on Sabbaths and feast days for the purpose of common prayer and religious instruction.

With the advent of Christianity and its great mission, we first meet what is known as the Church Edifice.

The word Church, derived from the Greek Kyrios, meaning Lord, may refer to either the edifice or the body of Christian people; hence, the church edifice being equivalent to the Lord's house. In this will be seen the connection between the Jewish synagogue and the early Christian church, gradually making such changes as were necessary to adapt it to the requirements and conditions of the Christian service, in which the people were all to participate, and for the addresses which have been a part of the service from the beginning.

Vast cathedrals and immense piles of brick and stone did not originate in the necessities of a New Testament church, but in the desires and ambitions of an ecclesiastical aristocracy. Nevertheless, is it not a fact that the magnificent churches and cathedrals of Europe have done much toward the development and preservation of Christianity? From time immemorial the finest works of man have been the temples or structures erected as places of worship, or dedicated to the Deity; and of

some periods—notably the Dark Ages—the remaining works consist almost wholly of ecclesiastical buildings. Thus architecture, and especially ecclesiastical architecture, has to a large extent been the historian of the world.

Thus art and religion are inseparably united, in that art is man's worship of beauty and idealizes the symbolic expression of those dreams and emotions which pass experience and transcend ordinary modes of expression. Art not only owes to the religious impulse its noblest incentives, but becomes the only means whereby religion can fully express itself. Through music, poetry, painting, sculpture and architecture, Christianity can appeal directly to the human soul with a force and directness that are irresistible.

In the period preceding the Fifteenth Century there was a growing religious enthusiasm, during which the church was the one great social fact and influence that ruled mankind. It inspired, demanded and absorbed all the activity of man's more peaceful moods; took the entire tribute not only of his heart, but of his mind, hand and purse, and absorbed nothing more fully than art.

In its cathedrals, temples and churches were expressed all that we now express in our public buildings, our charitable institutions, our civic adornments and our sumptuous private houses. Into its treasuries went all those minor works that are now dispensed to a myriad secular ends; hence the size, richness, pomp and splendor, the magnificence in effect, and the lavish care in detail of the medieval sanctuary.

It can hardly be questioned that the medieval architect was inspired; not by the essentials of Christianity; not by those things which the simplest of the sects claim to hold in common; but by the specialized demands of the Church. By study we shall see how they grew up and grouped themselves as the ritual expanded and crystallized into shape, absorbing a thousand beliefs, traditions, rites and ceremonies. Thus while the church edifice of primitive Christianity was an adaptation of the Jewish synagogue, the cathedral and later church were evolved not from the temple or synagogue, but the basilica, a combination of the hall of justice and the market place.

During the Fifteenth Century churches and cathedrals were built in half of the cities of civilized Europe. This was a period of gigantic religious enthusiasm. At this time, owing to religious revolutions and other kindred causes, architecture as a vital art came nearly to an end—one of violence, not of exhaustion—

with but little if any indications of revival until within the past century, which has marked a remarkable architectural awakening, especially throughout this country. Owing to the peculiar social and political conditions under which we live, there is no call for structures other than those designed for religious, civil or domestic uses. We have now entered a new era of religious architecture, and it behooves us to ascertain what the modern church edifice should be. Shall it be an adaptation of some acknowledged type — so-called orthodox? And why orthodox? Was not one borrowed from the synagogue, and the other from the hall of justice? Both were perfectly adapted to their requirements, and therein was their chief excellence; they perfectly supplied the needs and requirements of the service of that day and age. But has there not been an advance, a development during the centuries? Have the needs and requirements of the service remained the same during this architectural dormancy?

It is true that the medieval church *can be* used for modern forms of worship, but we can say as much of any spacious interior, and the plea of partial appropriateness which is valid with reference to the venerable structures, strikes below the mark when new creations are in question.

To those who profess such profound veneration for things of the past because they were "orthodox," and would reproduce the churches of centuries ago, we would inquire if they would be satisfied with the habitations, conveniences or social customs of that period; if the educational standards, institutions and advantages, the statesmanship and morals, would find favor; if the same means of transacting business and travel should not be considered orthodox also? If not, why should there not be a religious growth, as well as a worldly one? *Is not Christianity the pioneer of civilization? Should it not lead rather than follow?*

Every form and character of the service has been changed. It is no longer a sacrifice offered for the people by the priest; no longer a gorgeous ceremonial to be but vaguely seen; no longer an elaborate musical rite in a strange tongue, but a common act in which the laity take a far more direct and personal share, and of which every word must be caught by all. It needs no chapels for a populous pantheon of saints; no spacious chancel for a numerous clergy; no broad aisles for processional pomp or show, and even the altar gives way to the communion table.

Moreover — and this is the important point — that love of physical comfort, which is a peculiar modern characteristic, asks for cushioned, stationary seats, unobstructed sight and sound, warmth and ventilation, and for thorough lighting both by day and night, and the utilization of all modern conveniences.

In our search for ecclesiastical feeling we now question the literal rendering of the medieval. Rightly we demand that such feeling *should* exist, and we believe that it can be wrought through some of the medieval moods more easily than any other way. Naturally and rationally, a free adaptation must not be expected.

Our ideal structure will be the natural result if our minds and hearts are given full and true expression. We have awakened to a perception of these facts gradually, and forced to acknowledge that the ancient ecclesiastical type is not so entirely adequate as we once supposed.

The problem we have is as novel as it is difficult and important. Nothing just like it has ever been proposed before. "Since other nations have built naively we must build self-consciously, distracted by the very schisms of the legacy they have left us."

No man or generation can master it. Each must do his part, for thus architecture grows. Each must study the problem from the centre outward; not from the outside in. Only by this process is it possible to grow and broaden. First set the bones and sinews, then clothe them with the integument of beauty. We must break away from the trammels of convention and precedent, unseduced by the cheap charms of wilful novelty, build churches in which the desire to secure *fitness* shows in a marked and interesting way. Our new needs are not of a single or even fixed sort. No one type of a church will serve every want, as it might if a single communion ruled the land.

There will be ever-varying solutions to the ever-varying problem. Some may require an adaptation distinct from the imitation of former fashions; some may necessitate a process of thought as distinctly creative as can be any which concerns itself with architecture. Fitness *is* and *must* be the predominant law. In these days of the growth of the Church in America, it will fall to the lot of the majority of the clergy, and many of the laity, to be connected at some time with the work of church building, and there can be no more serious question than that of the proper building of the structure which is the earthly tabernacle of God, and the temple wherein are solemnized the ordinances of the Faith.

Not only this, but on the designing of the church may depend the success or failure of the given work, for a church which is an inspiration and impulse to worship will work silently but surely for the strengthening of Christianity; while a tawdry or barren building will be not only an insult to God, but a hindrance to the faith.

It is wicked in a church wealthy and strong, to consent to worship in a barn of a house, which by its inconveniences and unsightliness, offends the proprieties of life in a Christian and cultivated congregation. *We "must not let the Ark of the Lord dwell in tents while we live in houses of cedar."*

The best in the range of our ability consistent with other Christian demands should be given to the house of the Lord, and wealth and science, taste and culture should be laid under contribution for this purpose.

It is equally foolish and wicked for a church to erect a house of worship far exceeding in size, architecture or ornamentation its needs or ability, and thus paralyze itself for all other Christian work.

God requires of man according to that which he hath, and not according to that which he hath not. Churches should avoid both extremes—not content with anything less than the best they can afford, and not guilty of a foolish extravagance, the result of false pride, leading to a paralysis of church life.

It is argued that the grand specimens of architectural beauty with their vast treasures of art have been a blessing to the world by their elevating, educating and refining influence on the people, and there is much force in this. But how much have they contributed to the purity of Christianity or the evangelization of the masses? Is it not a fact that in the lands where these magnificent edifices most abound we find the lowest grade of morality among Christian nations? Have not the men who have been the most distinguished for their piety and have made the stronger impress on the Christian world, worshiped in the less pretentious edifices?

In our own country the denominations which have made the greatest religious impress upon the people are those who have been unassisted by grand houses. The church edifice in architecture, appointment and ornamentation should be in harmony with the wants, habits of life and taste of the people who worship in it. The newly-settled country wants its mission chapel, while the wealthy, fashionable and refined audience of a city demands a house in harmony with the environment, the

ability and taste of the people. Either would be sadly out of place and of no practical utility if transposed.

There is an eternal fitness to all things. The church edifice, whether humble or magnificent, is erected for a purpose, and the first aim should be adaptability. In it should be combined suitable provision for accommodating, in the most effective manner, all the various possible requirements of the service.

There is no question but that we can sing, pray and exhort one another to be unwearied in well-doing; that we can hear the Scriptures read and listen to an instructive sermon in a barn or tent, feeling that our dear Father will be just as well pleased with the service as if we had toiled and taxed to build a magnificent church. Still we prefer the beautiful edifice. We chose it for our own sake and for what we owe the community we live in.

The question seems to thus present two issues: Does the benefit derived from its visible beauty constitute its chief excellence, or are the other uses and purposes for which it is erected paramount? One or the other must be subordinate.

There is much truth in the assertion that "if we take care of the beautiful the useful will take care of itself." Is there not much more truth in the converse, if we rightly apprehend the sublime height, depth and boundless comprehension of divinely beneficent *utility?*

Beyond question every church dedicated to Divine worship should be as beautiful as human hands can make it; not with the beauty of fashion, but the beauty of holiness. For this no other foundation or precedent is possible than that of absolute truthfulness—truth in design, material and motive.

The Christian Church is said to be responsible for a vast amount of cruelty to the human race, and surely there can be nothing in its way more painful and damaging to the wholesome instincts of an innocent people than the architectural crimes that have been committed in its service.

The exterior, or that portion of the church visible to the public, and from which first impressions are obtained, is essentially the architectural feature or style. The appropriate style is that which most clearly and earnestly expresses the purpose for which it is erected. This is the primary principle of all good architecture. The structure should be an outgrowth of the spirit of Divine worship, and its visible form should excite reverend admiration and delight. There should be a righteous use of material. The whole should be a question of morals as

well as of taste. It is well said that the number and character of the church edifices is a safe index of the character and morals of any community.

It may not be possible to build a house as stately and beautiful as some would desire. God only requires of us what we can do. A man's duty to provide himself and family with a place of worship is as much a duty as to provide them shelter, food and raiment, and to do this he should no more throw himself on public benevolence than as an individual. Failure on the part of a professed Christian to do his duty in one case is robbery of his family; in the other, of God. As Malachi says, "Will a man rob God? Yet ye have robbed me. But ye say, 'Wherein have we robbed thee?' In tithes and offerings," which had been withheld. Both extremes, extravagance as well as parsimoniousness, should be avoided; either will prove a curse.

There are however extraordinary cases which form exceptions to all rules. Churches may be so located that the manifest interests of Christianity demand a better house than the people can build,—such as educational centres, summer resorts, mission fields, etc.

Under any and all possible conditions, the building should be adequate to all present demands or requirements, with ample room for future growth and increase, and in harmony with the environment, the customs, habits and tastes of the community.

Owing to the fact that churches are not marketable commodities, to be disposed of if unsatisfactory, as other buildings, but must be retained as an inheritance of unpleasant reflections and memories for generations, and often to the serious detriment of the cause, greater precaution should be taken in judiciously and wisely determining and transacting all the various details of the business in connection. As a lack of precaution or care in its initial stages, an error once incorporated, becomes an integral part, a regret, indicated by those "saddest words of tongue or pen." Plan and build so wisely that future generations will rise and call you blessed. It has been well said that a *mortgage* can be removed, but there is no remedy or recourse for a *regret*, which is a permanent incumbrance. Therefore, avoid the latter as you would evil. Too much emphasis cannot be placed upon the fact that this is preëminently a case where an ounce of prevention is well worth a pound of cure.

Church edifices should be solid, substantial and permanent; should be erected, comparatively speaking, for all time; so that the erection of a church under normal conditions is a matter

that may occur but once in a lifetime, and the charge of same is a sacred trust. So many, we may say thousands, of items of detail enter into the matter from the first inception to the completion, all of which should and must be fully considered at the proper time, that their mere enumeration would fill a volume. All the various possible uses, purposes and consequent proper planning, consistent style, availability, adaptability and economy of various methods and materials to be used in construction, selection of modern conveniences, proper proportions and means of securing desirable and necessary inherent properties, require careful, prayerful and judicious consideration.

But consideration alone will never enable us to avoid errors. Many plans, methods, systems and materials are offered, each individually possessing merit. The question is not always which is the best. The peculiar conditions of each case and application must be considered, the question of advantageous adaptability being the vital one.

To be able to properly consider all of these vital questions, requires experience. Experience is the result of experiment, and experiment to be of value, and to demonstrate superiority, necessitates failures. For any one in any business to pass the experimental stages, requires years of extensive practice, all of which is educational. No one, even to obtain the best results, can afford the time or secure the opportunity to thus acquire the necessary education — only acquired in the school of experience,— for its application or introduction in one or two cases. This principle has resulted in producing the various professions, in which is systemized and divided the intellectual labor and experience necessary to secure the highest degree of proficiency and perfection, a process of education never completed. Thus we look to the clergy for guidance in matters spiritual; to the legal for guidance in matters pertaining to the law; to the medical for guidance in matters hygienic; to the architectural for guidance in matters pertaining to the various structures, monumental, artistic, or utilitarian.

The same care should be exercised in the selection of our architectural advisor as in the selection of any of the others, as the advantage of expert advice, guidance and experience is as essential in the one case as in the others.

It is well said that the mistakes of the attorney can be corrected by the courts of appeal and equity; those of the physician can be buried, but those of the architect stand a lasting monument of folly and reproach.

It is generally conceded that a public office is a public trust. How much more, then, is a sacred office a sacred trust. When to the officials of any church is confided the duty of erecting a house of worship, the gravity and sacredness of the enterprise should be kept in view. If you lack the necessary experience, use the greatest caution in the selection of your expert guide, "lest the blind lead the blind," etc. This is not a case of "Where ignorance is bliss," but a case where ignorance is inexcusable, as such service *is obtainable.* Let no selfish, mercenary, or impure motive influence you. Carefully and prayerfully consider and investigate. This is the vital issue, the crisis. As everything depends on the course determined upon, individual preferences, local influences and prejudices must be subordinated. Investigate regarding experiences of others; the reputation and character of the man; his ability and integrity. All these matters are public property, easily obtainable. This is preëminently a case where the advice of Davy Crockett applies: "Be sure you are right, then go ahead," even at railroad speed, if you wish, as with all questions previously determined and a safe guide, you *cannot* go astray.

It has been said that "the American Church is able to boast of a collection of churches which for bizarre and grotesque hideousness equals that of the variety of denominations. Scarcely a city of prominence but can point to one or more churches conceived in the highest spirit of *the builder's art;*" and the reason assigned is that "Too often the question has been one merely of fashion, or expediency, or the predilections of some *careless, ignorant,* or *infidel* architect." The result is certainly a mockery. How can such buildings be dedicated to the service of God?

It can scarcely be doubted but that most of the failures of our modern churches may justly be ascribed to a lack or confusion of ideas as to the *real purpose of the church,* and a *practical infidelity* concerning its character and mission.

To more thoroughly comprehend what may be called the real purpose of the modern church, especially in America, it is necessary to briefly review its evolution and note the radical changes which have taken place in the service, systems and organization which have necessitated this remarkable development of the modern edifice.

Nothing could have less esthetic sentiment in it than the earliest houses of worship in New England, consisting of four walls of logs or a rough frame work of wood, clay plastered,

a thatch roof, with sometimes a floor. These buildings were appropriately called "meeting-houses" and were mere places of assemblage and nothing more.

The people at first repelled the idea of any sacredness in consecrated places, for in the same building were assembled the town meeting and the courts. The stocks and whipping-post, and sometimes the gallows were conveniently in front of the door; the early Puritans repelled with earnestness the idea that there was any special sacredness in consecrated places, and was considered a solemn protest against what they deemed a papistical and idolatrous notion, that holiness could inhere in wood or stone.

These buildings were nearly square with the tunnel roof, *i. e.*, a roof sloping from all four sides to the middle with a belfry perched on the apex from which the bell rope descended in the middle of the room. This form of meeting-house was also found among the New York Dutch and the Quakers.

The Anglican body however, with its roots in England, made an effort to adhere to or follow the prevailing style in English Ecclesiastical Architecture and some of the early city churches succeeded in attaining some character of an imitative sort. The Ecclesiastical Architecture of the colonies was never uniform, and that of New England underwent considerable modification with the disappearance of the austere form of

Puritanism; when the increase of luxury softened manners and a tendency toward regular ceremonial appeared in the service, the prevailing squarish meeting-house with its pyramidal roof began to give way to buildings with some ambition for Architectural effect; the house gradually assuming an oblong form and the belfry giving way to the tower surmounted by the spire.

Non-conformists of every shade, pushed their opposition to the ritual service and religious art to the greatest extreme. Until long after the opening of the Eighteenth Century the majority of the meeting-houses were as naked of ornament as a barn and the service divested of anything that might give esthetic pleasure; entertaining inveterate prejudice against instrumental music, some even rejecting psalm singing.

In the early houses of worship no provision was made for warming even during the most severe weather, and the separation of sexes was rigidly enforced. The box pews or stalls were introduced and the people were seated according to their rank. Galleries were practically a second floor with the central portion cut away, and were often unseated.

The evolution of the present forms of service and the house to accommodate it did not really begin until within the present Century, and mostly within the memory of the present generation.

CHAPTER II.

BUSINESS IN CHRISTIANITY.

PROPER STEPS OF PROCEDURE FROM FIRST INCEPTION.

VERY Church organization should be legally incorporated in accordance with the laws of the State wherein it is located, prior to the acquisition of property or the transaction of any business pertaining to the erection of a new edifice; should there be any question as to the validity or existence of a charter, or the election or qualification of the officials, or should it be deemed expedient to incorporate under some other statute or system, legal reorganization should be effected.

This should be done under the advice of a competent attorney. In this and every act wherein legal advice or counsel is essential, the service of a *Christian* attorney should be secured, to whom the principles and cause of Christianity are paramount.

The laws of some States determine by statute the qualifications of membership in the *incorporated* organization or society in which there is no religious test, and over which the church or society have no other than legal control: these qualifications are generally full age, regular attendance and customary contributions — including both sexes.

The primary idea of the church however is that of an organization for *religious purposes*, in which the test and qualification of membership is their own covenant and religious principles, and governed by what is known as ecclesiastical laws.

Thus it will be seen that in some States there is a *dual system;* in others, the dual system is *recognized* and *optional*, while in others the *single* system is fully recognized. In many instances there is special legislation either in favor of some local church or some denomination concerning this point.

Prior to organization, full and reliable data should be secured as to the necessary legal conditions; in this connection the

name or title should be considered. The word *Congregation* or *Society* should be used in the case of a *dual* system; and *church* only when all the members are members of the church. This course will avoid confusion.

Every church organization has likewise two very different kinds of business to attend to — the temporal and the spiritual; it is therefore amenable to both the *statutory* and *ecclesiastical* law. The legitimate work of the church may progress and be administered without reference to the *civil* law, but as soon as temporal motives or interests are employed to advance the work, such as the contribution of money for the acquisition of property, employ of pastor or sexton, or the erection of a house of worship, in which legal right or obligation is assumed — it must in this respect comply with the laws of the land. Where the *dual* conditions prevail, the *temporal* officers *must* be selected from and by the *entire congregation*, and the *spiritual* from the *church membership.*

By statute, a board of trustees is designated as the legal representative of the organization in all matters relating to the *temporal* concerns and revenues of the church, congregation or society; the trustees being however the executive board — in whom the corporate power *is vested* — and not the corporation; holding these powers and acting for the benefit of the body at large, according to the rules and usages of the denomination.

As soon as the organization acquires any property, or makes any contracts, it assumes *legal* rights and obligations, and must order its conduct in accordance with the statutory laws of the State wherein located. The services of men should be enlisted as trustees who appreciate the responsibility of the office, and who know how to transact business in a way that will not leave open the door to controversy, and who will not allow personal interests or sensitive feelings to swerve them from the line of Christian duty. *The same principles should govern the transaction of church business that would apply to commercial business or personal affairs.* Too often is it the case that means are resorted to and methods pursued that the individual would scorn to consider in the transaction of his personal affairs. The ends *do not* justify the means. A high grade of morals should prevail in the transaction of church business, in order that the church does not lose the respect of the community. The trustees are the legal representatives of the church, and must sign all obligations; while committees may be appointed to attend to and arrange the details and take charge of temporal matters; the contracting powers cannot be delegated;

delegata potestas non potest delegari, is a legal maxim. All transactions should be properly recorded and all committees report in writing; then complete reports can be made.

Preliminary to the erection of a new church, the building committee should be appointed: for this committee representative men should be elected, men of great breadth of character, thoroughly familiar with the requirements of the Church — Christians, in entire sympathy and accord with the enterprise; unselfish men who have no friends to favor, no enemies to punish and no "axes to grind;" in number, three are sufficient — three will represent the congregation as well as more. "Many men of many minds" is often demonstrated in large committees. But *one* church is to be erected, and that in but *one* way; to suit *all* would often necessitate a different church for each individual. At this stage, and prior to the selection of a lot (unless already possessed), definite plans should be determined upon. In too many instances the lot is purchased without reference to the building, and on which no satisfactory building can be erected. Too often is the committee hampered by unfortunate location, conditions or surroundings, or an inadequate lot. The best possible site should be obtained on which to build; it should be central and convenient of access; if possible, secure a corner lot. Better pay full price for a *proper location*, than to accept one as a gift whose location will always be a detriment.

Compactness is an essential; access to the various departments can be secured with a corner location far better than with a middle lot, unless of such generous dimensions that an isolated building can be erected without any hampering conditions. The church should not only be attractive, but its location should be prominent; "the light should not be hid." If several advantageous locations are available, the previous determination of plan and advice of an experienced architect is essential. The orientation and topography must be considered in their relation to plan. A gleaming sun in the eyes of the congregation during service is not conducive to a spirit of worship or content on the part of the audience, and may, in itself, cause your new house to be avoided. A "side-hill" may be of advantage if inclined the right way; hence all these matters should be considered before committing a serious error. Proper surface drainage and possible prevalence of ice about entrance during winter should also be a factor.

An honest, conscientious man, with full confidence in his own ability in all ordinary building operations, will have misgivings in determining matters pertaining to the church home;

there is much more at stake than the mere matter of taste or judgment; there is a question of trust, the question of principle, of duty to God and man, of acting for the welfare of a community rather than the inclination of the individual, and oftentimes the success or embarrassment of the cause. Much study and discussion must precede the work. In the Master's service we owe the best we can give, not only of intellectual effort and heartfelt devotion, but of all material things that are under our control. To direct this effort is a great responsibility; hence the emphasis placed on the selection of the Building Committee.

If free to act, the method of procedure would be as follows:

FIRST. The policy of building a new church is to be determined; also the *approximate* requirements of same, with proper allowance for future growth and needs, and the ability of the congregation. The Building Committee should then be appointed, who should proceed in accord with the *approximate* conditions. Prior to any other action, the questions to *definitely* determine are: What ought the church edifice to be? What kind of a house should the church have? Where should it be located? and How should it be erected?

At no stage of the proceedings is the value of experience and counsel more essential; hence the services of a competent, conscientious, reliable and reputable architect should be secured; one should be selected of wide experience in *ecclesiastical* work, extensive practice and unblemished reputation, who should maintain the same relations to the committee a legal or medical advisor would; he should be, *ex-officio*, a member of the Building Committee, and fully and correctly informed regarding all conditions, requirements, etc. In no other way will he be competent to advise. When all leading questions have been discussed, and their practicability and expediency determined, the development of the plans and elevations can proceed intelligently and definitely.

As the succeeding processes are largely mechanical, the matter should receive careful consideration *during development*, as no change should be made under any pretence whatever after approval. The opposite course is the one more often followed however; *i. e.*, the lot is first selected (some selfish interest quite frequently determining); the character of church, capacity, materials, cost, etc., all determined upon, and then an architect *employed*, not *selected*, often a man without experience, to whom is given the problem in which *all factors are fixed*, rendering it impossible of solution; but rather than acknowledge inability,

which might be construed as incapacity, the work will be undertaken. As *all conditions and requirements are dictated*, the work of the architect becomes that of a *draftsman* only; in this capacity a desperate effort will be made to comply. The resultant, unsatisfactory building, unexpected bills of extras, defects past remedy, etc., will too late demonstrate what *experience would have avoided.* However, the best must be made of a bad job, and all endeavor to persuade themselves and others that they have done the very best they could, and that *it might have been worse.*

Is this not the *real cause* of the many unsatisfactory church edifices, which are a *hindrance*, rather than a *help*, to the cause? The *real* and *valuable* work of the architect *precedes* that of making the drawings, *in assisting the committee in the determination of the essentials*, so that the *best plans, systems and arrangements* may be fully considered and the capacity, materials, style, etc., discussed, so that the essentials finally determined upon shall be possible, practical and of the greatest advantage.

Is it not too often the fact that these same matters are determined by persons who have never given a moment's consideration to the subject prior to their appointment, and who acquire the necessary education or information to determine questions and matters of such import in the few hours' consideration not devoted to other business? It does not follow that because Brother A. is a successful merchant, Brother B. a successful banker, or Brother C. an efficient mechanic, that they are qualified to pass on *all* questions. Neither is it any reflection on their intelligence if they cannot or do not.

The selection of an architect is too often determined *because he is a member of the church, or a promising relative of some deacon, or a local practitioner*, and, as such, *must be patronized.* If a stranger, a few fine pictures which he may *not* have made, and a half hour's talk learnedly on architectural subjects, agreeing to perform impossibilities with a nonchalance that is assuring, may win the committee. Or it may be in *competition*, wherein fine drawings of *impossibilities* are presented *to catch the eye*, or some member of the committee is flattered with his knowledge of architecture, acquired the night before from a few hours' study of the encyclopedia. A pleasing speech is made, wherein everything is claimed with assurance, "fools always venturing where angels dare not tread." The selection is thus made, and the committee congratulate one another that the matter is at *last* decided, and that they finally have some one to assume the *responsibilities* under their *dictation.* Is this the commendable

course? Will this assure the best results? The selection has been made *entirely on superficialities*, and the ambitious aspirant with *no demonstrated ability, beyond that displayed in securing the position*, and *experience equally extensive*, is the guide.

Responsible, reliable architects of *experience* have *not* been considered *from the very conditions.* A competent architect spends years of study in acquiring the experience and knowledge that may be of value when properly appreciated, and will not consent to being hampered by limiting conditions imposed, when he is cognizant of the fact that they are radically wrong, or resort to such questionable methods or subterfuges to secure employ. The services of an architect are those of an *expert, experienced advisor*, rather than those of a *mere draftsman.* The unfortunate conditions prevailing, whereby the qualifications of an architect are not legally defined or prescribed, is largely to blame for this. Anyone who has the presumption to call himself an architect, *is* one to all intents and purposes, and against whom the public have no legal protection or redress.

The only protection the public have from imposition is the *reputation, references* and honor of the architect; hence the more reason for care in selection.

On the supposition that the committee, after organization, by commendable and legitimate methods have secured the service of a competent, experienced architect, they are now ready to select a site, of which several are available. In addition to the location, its adaptability for the reception of the proposed edifice must be considered, which brings in at once the vital question, *What ought the church edifice to be?*

Every building is erected for some specific purpose, which must be determined beforehand. If it is purely monumental, then place the emphasis on the exterior. If for service, then the needs and requirements of that service must be considered, which necessitate a full consideration of the interior arrangements. In the former, only architectural style, taste and expense are factors, while for the latter, many conditions, relations and essentials enter the problem, all of which must be duly considered. In determining this, the great complexity of the problem appears.

For simplification, the problem, therefore, must be resolved into its component parts, and systemized. First, then, the real question to decide is: For what purpose or purposes is the church to be erected? If for church services only, the problem will be comparatively an easy one; but if the building is for the

accommodation of the various auxiliaries, properly a part of the Modern Church service and work, the problem becomes *more complex*. The character of organization and system with the consequent divisions, subdivisions and departments to be accommodated must be determined.

For the various uses and ordinances of the service numerous rooms or apartments will be necessary. To economize and aid in the service, the relative juxtaposition of the apartments must be considered, that they may serve a *dual* purpose, and that the various combinations thus secured shall be practical and of advantage. The capacity must be considered, such as the average fair weather attendance, and the accommodation for special occasions. Due allowance must also be made for future growth and increase.

When these questions are determined and fixed, we arrive at the matter of cost. What is the limit of financial ability? and largely determined by this. Of what material and what character shall we build?

There are thus four prime factors to this ever varying problem: The requirements,—the limit of ability,—the material and character of building,—and the cost. The problem is solved by "the rule of three." Happy is the committee who can, when determining the factors, establish the proper ratio. This must be determined before another step can, or should be taken.

If the members and officiary are enthusiastic, the problem becomes elastic, consequently more easy of solution. Having determined the requirements, the approximate size and most advantageous form of edifice will develop; this will thus serve to determine the adaptability of the various sites, the one preferred may not be of sufficient size, or of proper proportions, serious changes may be necessary to adapt the plan to the lot, in which the *entire utility of the building would be sacrificed*, and the *system of organization may be rendered impossible by the conditions;* thus will be seen the vital necessity of the course of procedure commended. The location should be procured to fit the building, not the house planned to fit the location, which latter course is the one most commonly pursued, and is often a fatal error, discovered too late to remedy, thus crippling the efficiency and discouraging many a society in their work. The development of the Modern Church and its various auxiliaries, with the essentials of a plan of building for its accommodation, will be treated later as a special subject, demonstrating the principles herein referred to.

Having now secured the services of an architect, determined the character and expense of the building, and secured a satisfactory site, (the title of which should be properly examined and secured) the formation of other committees, for other work, in connection is essential. A finance committee should be appointed, of persons properly qualified to secure the necessary funds. It is presumed that preliminary subscriptions or donations have been made, assuring success, but no thorough canvass made. For this purpose various methods are adopted. Probably the most satisfactory one consists of issuing a leaflet containing cuts and descriptions of the proposed edifice, practically as determined, with a detachable subscription blank, on which is embodied a mutual agreement to the effect: "That in consideration of the efforts of the trustees to raise a certain amount of money for the purpose of erecting a new church edifice, on certain specified lots, and in consideration of their agreement to receive and hold such fund, and apply the same to the construction of said building, to be in substantial conformity to the cuts and description, and in mutual consideration of the agreements of subscribers thereto, to pay the sums they will subscribe. The various subscribers promise to pay the trustees of the said church certain specified sums of money, at times, and in manner as set forth."

This forming a special contract between the subscriber and the trustees, having the force of an obligation, endorsed by every subscriber, and for a specific purpose.

Many refuse to subscribe, urging as an excuse that they do not know what they are subscribing for; others want to see the result first. The above method will overcome these objections. Another method based on the cut and description agreement, is to have the various subscribers agree to pay stated sums, weekly or monthly, until all expenses are met; this lacks definiteness however,—various other methods best adapted to the different conditions and localities are adopted, with more or less success.

Ordinarily the church should be built by the contributions of the congregation for whom it is intended, and if possible should be erected without debt: Hence the aim of the finance committee should be to secure a sufficient amount by legitimate means to meet the estimated expense. The fact that competent, trustworthy men are in charge will do much toward inspiring confidence, and men will give more freely, and sacrifice more cheerfully, when they feel that the best possible use is being made of their means. In all matters, *adhere rigidly to business principles*, remembering that the Lord's business is the most im-

portant of all business. Having decided definitely, as to place, capacity, material and style, and knowing what is wanted and intended before beginning, a deaf ear should be turned to all suggestions for remodeling, changes or modifications.

There will not be wanting those who will suggest numerous changes, who do not know the alphabet of church building, and in consequence cannot read a plan, hence are not competent to express opinions on the subject. It is presumed that those in charge have carefully considered all matters, in all connections, and have determined, as they thought best. No change, however insignificant, can be made without involving others, and may be vital, so as to necessitate an entire change of construction. A trifling change,—for instance, the removal of a pier, or opening, or the change in location of a partition wall or doorway, if only a few inches,—may not apparently affect anything; but when the roof is reached, is found that a main support is removed, and the very nature of the roof construction will not accommodate itself to the change, necessitating an entire change in this, which will necessitate many others. Conditions may prevail, which will make this and all resultant modifications complicated and expensive: Thus while the expense of the change itself may be insignificant, the consequential and incidental expense and damage may spoil the building and materially increase the cost without corresponding benefit.

Especially guard against any effort on the part of builders to induce changes; they frequently desire,—especially when working under contract,—to open a door for a bill of extras. Changes may be necessary, and may be advisable in some instances. When considered however they should be considered under the advice and counsel of the architect.

An efficient, careful and experienced architect thoroughly considers or should consider *every detail* of construction, practically erecting the house in his mind, during the development of the plans, and has provided for every emergency; consequently the reasons for all things may not be apparent in the beginning, but eventually it will be found that there is an object or purpose for every part. Therefore the plans of the architect should be adhered to literally; should anything be vague or misunderstood, or should an error be discovered, he should be applied to, for an explanation or correction, as the error or discrepancy may only be an apparent one.

Before deciding on any change that may be deemed necessary, he should be consulted and requested to arrange for same.

Competent and honest contractors should be selected, as no amount of skill or zeal on the part of the architect or superintendent can compensate for a lack of efficiency on the part of the contractor or his workmen, a high standard of work may be required which the workmen are not competent to execute and may not even comprehend. *Doing the best they can* is not always a sufficient excuse. The contractor should be required to employ efficient workmen. Oftentimes more time is spent in covering up bad work than would be necessary to do good; all these matters should be considered in a contract.

When the drawings are fully prepared, various contractors are invited to submit proposals for the execution of the work in accordance with the same and the specifications accompanying. In this, only invite such contractors as would be entrusted with the work if awarded the contract. Receiving proposals from parties who would not be considered is not just and results in confusion and often trouble. All notices should plainly stipulate that there is no obligation to award the contract to the party submitting the lowest proposal, also reserving the right to reject all. In the absence of any such notice, the presumption is that the lowest proposal will be accepted, and if rejected may result in litigation.

Proposals may be received and contracts awarded for the whole, or divided among different contracts; the former course, except for special work, seems the preferable method, as a contract for the *whole* will without question *include everything pertaining*. Otherwise there may be many items difficult to determine where they properly belong. Conflicts of interest and lack of harmony will most certainly result in annoyances, if not unexpected expenses. In all matters pertaining to contracts, it will be advisable to be guided by the experience of the architect, who should advise as to methods and determine as to the proper forms. He should be consulted on all points, and when contractors shall have been selected and the details of the agreement determined upon, should write up the contracts, in which shall be stipulated distinctly *the proposed location; the time to commence work on contract; time of completion; forfeit—if any—for non-compliance; agreement as to insurance; procedure in case of unsatisfactory work or materials; power and authority of the Architect, Committee or Superintendent; the contract price and the time and manner of payments;* also a *protective clause in case of strikes and the amount and character of bond required, if any.*

The contract should be legally signed by the Contractor and Trustees and the bond properly executed. As the laws of different

States vary in minor points as to forms, etc., the same should then be submitted to the Attorney as regards legal compliance. The Standard form of contract which is generally adopted complies with the laws, and would be considered, if properly executed, a legal contract anywhere in the United States; minor technicalities constitute the main differences. The experience of the Architect in building matters peculiarly fits him to attend to matters pertaining to building contracts, and to protect the interest of his clients, better than can be done by any other.

In awarding the contracts, it may develop that it is impossible to secure a competent builder to assume the contract for the stipulated amount. The carefully prepared estimates of the architect should avoid this contingency; still they are not infallible. The matter of cost is largely one of opinion. Quantities of material may be carefully computed, quality and character of same are determined by the specifications, all having a market value. *The exact amount of labor required* is however largely a matter of *opinion* or *conjecture*, although same may be approximately estimated, while the *price* of labor is *determined or definite.*

One contractor may possess advantages and facilities not possessed by others, and may calculate on larger profits. All these varying conditions will result in varying prices. Hence it need be no surprise to receive proposals from equally responsible and efficient men varying as much as fifty per cent. If contractors with fixed conditions thus vary, it need occasion no surprise if the architect should. He may be over-sanguine in his ability, or hope for favorable conditions and estimate accordingly, or he may be conservative and anticipate the worst and thus estimate high. His experience, knowledge of conditions and prevailing prices, should enable him to arrive at as conservative an estimate as can be made in the preliminary stages. If it should develop that no proposal can be secured within the limit, the question will then arise, What modifications are possible without detriment? The fertility of resource of a competent architect is generally competent to adjust this without difficulty.

Whatever is determined on should be thoroughly indicated, agreed to and incorporated in the contracts, so that no further change will be required. Matters pertaining to the esthetic or artistic adornment or embellishment of the Church, or involving the services of the specialist cannot be determined by competition: to secure the best results other methods should be pursued. Works of art are not to be secured by those processes which pertain to the purchase of marketable materials or the employ of

mechanical labor. *The value of professional, artistic or special services are not determined by price or quantity;* these matters will be more carefully considered elsewhere.

Contracts having been awarded, and all details of erection and completion provided for, the various processes are largely routine and mechanical to completion. The long anticipated day of dedication at last finds everything completed and in readiness. Prior to dedication all settlements should be made, all expenses provided for, and all reports completed.

No Church should be dedicated to the service of God subject to a mortgage unless fully provided for, neither should it be liable to a lien. Business in Christianity should be as strictly adhered to, and common honesty and Christian manhood guarded as carefully, as ideas of dignity or position by the world.

The Church thus erected, completed and dedicated is sacred to religious uses and the business necessarily attendant, and should be used in every way that is promotive of religion in its broadest sense. The legal title, care and maintenance is in the hands of the Trustees, for the regular and legitimate uses of the Church. The Pastor and Officers of the Church have the right to decide on the number and times, as well as the character of the regular church services. But for any *special* purpose, the concurrence of the Trustees or their representative should be sought. And the propriety of its use in any particular case should be determined in view of, and in accord with the rules and usages of the denomination, the condition of the community, and the nature of the proposed use.

The Trustees have no right to grant its use for other purposes without the assent of the Church; neither have they a right to close it against the services of the Church, except in case of necessary repairs or renovation.

CHAPTER III.

WHAT.

INTERIOR REQUIREMENTS—DIVISION AND SUBDIVISION.
SYSTEM—INDEPENDENT OR COMBINATION.
EXTERIOR—CHARACTER, STYLE, ENVIRONMENT.
IDEAL—THE SOCIAL OR INSTITUTIONAL CHURCH.

RIOR to determining what a Church Edifice should be, thorough familiarity with the various requirements and purposes are essential. Each individual case requires consideration and careful study, the customs and habits of the community, the peculiar practices and ordinances of the different sects or denominations, as well as the constantly developing auxiliary work, essentially a part of the Church service, must be considered and properly provided for.

To please all is impossible, but few have a conception of what is really proper or best. Some place emphasis on one feature, some on another; with most, opinions are formed largely with regard to superficialities without regard to the inherent essentials. To harmonize the various views and requirements, necessitates a careful analysis or diagnosis of each individual case, which will produce results radically differing, even when the conditions and requirements to the superficial observer are apparently the same. All this will explain why it is practically impossible to duplicate church edifices, in which the organized work of the church, the financial ability, the estimated accommodation, the dimensions of lot, the topography, and the location with reference to streets and orientation, should all be the same to justify duplication; to find instances where these several conditions are identical is practically impossible. Should such a case be found however, then individual preference or other reasons will determine a different material or style of architecture or divergence in minor matters—so that with the modern

church and its multitudinous requirements, any set or fixed plan, order or style is impossible and the stereotyped or ready-made plan unsatisfactory.

The modern church however is not an original creation or revelation; it is rather a development or adaptation, keeping pace with the growth and development of the work of the church, and should at all times be consistent and appropriate for the purpose. Every Church building is erected for some specific purpose, and the form best adapted to serve that purpose is the proper one.

The statement will not be questioned that the principal use of the Church is to afford an opportunity for a large number of people to hear the Gospel preached. The people must also be able to take part in the service. This however is not the

only purpose and it may even be questioned if it is the principal, if there are not others of equal importance. Is not the modern Sunday School in its fullest development an essential part of the Church? Are not the various auxiliaries but parts of the one great Temple for the worship of God, the study of the Scriptures and the service of humanity? Then shall we not consider the modern church edifice in its broader sense and in that capacity ascertain its requirements?

The Church Edifice should not be erected solely as a home for the Church, but as a means of reaching the masses and bringing them within its influence. To accomplish this the uses of the Church property should be enlarged under proper restrictions and the building as well as the service made attractive.

Can it be expected that the Church with four to six hours on Sunday, will be able to successfully counteract the influences of the temples and nurseries of vice which are running night and day, often seven days of the week?

This development of the work of the Church should be systematic and not left to the conviction or opinion of the Pastor or a few members, but should be determined as to character by the body. In thus giving more scope to the uses or work of the church, we find that as ordinarily planned the buildings are incapacitated for use by lack of conveniences. New buildings therefore should be arranged with reference to all these requirements.

This mutual development of the work of the church and the edifice for its accommodation will result in an Institution, and the Institutional Church, which is truly the "Ideal Church."

The Ideal Church should minister to the whole man: spirit, mind and body; should preach, teach, heal and reach the spirit through the body and mind. To accomplish this the church must break from the conventional traces and introduce new methods. Let innovation follow innovation. The church has long taught the love and sympathy of Christ, how he came to save sinners, not the righteous, and the masses feel that the church should show the same love and sympathy in a practical way. The interior therefore must first be planned and arranged to meet these various requirements, and then the exterior designed to consistently give expression to and explain the interior and indicate the character of the edifice, with a force and grace of outline in proper proportions and harmony. How often is the opposite course pursued and utility and convenience sacrificed to secure a handsome, attractive exterior!

In arranging the interior, the requirements of the various branches or departments of the service must be considered, and

their relation to each other, so that the work may be facilitated rather than hindered. This will develop several independent plans of arrangement for the several departments, which must be modified to adapt them to the various combinations.

First will be considered the Auditorium. This has long been considered "the church." In the majority of cases consisting of a rectangular apartment, with a vestibule and "steeple" and sometimes a chancel, developed in a variety of forms and styles. On what is this ancient form based? From what is it derived? that we should so rigidly and sacredly adhere to it as orthodox?

Architectural origins seem strange enough when we try to trace them out. We find that the medieval church was derived from the basilica of Pagan Rome or from an adaptation of the Jewish Synagogue, which was in turn modeled after the Temple. Their history teaches us that we may borrow where and what we will; a plan one place and a design another, sacred or profane, but the vital fact that justifies or condemns, is that we must blend them chemically and not mechanically; we must make of them a new body, so to speak. All this may be inspiration; inspiration drawn from precedent. With some there is a veneration for these established forms, a feeling akin to the regard of

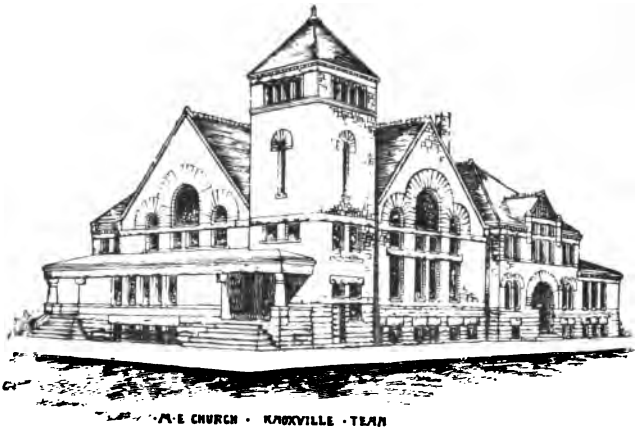
the Jews for the Temple; their views should be respected, as they are closely connected with the faith, but are largely those of association not easily transferred to a new building.

In the Ideal Church an ideal auditorium is essential, in which the minister should be able to see each member of the congregation, and of such shape that the audience is as compact as possible, and, so to speak, within the angle of vision. The speaker should be so located as to be within the closest personal sympathy with those he would instruct and lead. As the oblong, rectangular auditorium and straight pews do not secure this result we must ascertain what will.

Instinct is often a safe guide where even reason fails. Observe how an audience will shape itself about a speaker in the open air where each instinctively endeavors to secure the best position; how the hill-side or natural amphitheatre is selected; how they form concentric circles to the front and sides. From this the ancients secured their models, and based on this the Greek theatre was constructed. In wordly matters those interested have been quick to adopt any idea or arrangement of advantage or profit. The best forms and all improvements for hearing, seeing and for individual comfort have been developed and are utilized to their advantage. Is there any valid reason why the modern type of Church should not be based on the Concert Hall or Opera House? Was not the church originally developed largely from the Pagan Temples and Basilica? Does preëmption give the enemy prior or exclusive right to all features or forms of advantage or comfort? Is not everything devoted to sacred uses sacred? Should not our church be as comfortable and attractive as buildings devoted to secular uses? The auditorium should therefore be provided with seating semi-circular in arrangement, or may be pulled out to the elliptic. On the centre of the one side facing the seats should be a platform for the speaker; the seats should rise as they recede from the platform and will form concentric curves, every one facing the pulpit squarely. For access and egress there must be a commodious passage, entirely around the pews next to the outer wall, with inner radiating aisles dividing the seats into convenient lengths. The proper height of platform, the incline of floor as well as the intersection of levels

with incline, must be determined by rules governing the laws of acoustics and sight. Necessarily the floor will assume the form of a half bowl, hence called "bowled floor," with a certain distance from the pulpit, and the space back of seats level. Variations in the height of pulpit, platform or incline of floor are often fatal to perfect acoustics and must be duly considered and determined with the dimensions and proportions of room and other features.

Essentially a part of the service which must be provided for is the music, generally consisting of organ and choir. In arranging for this there is and always will be a great diversity of opinion, hence we find the quartette, double quartette and



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chorus choirs, with the organ, the orchestra, and cornet in various combinations, adopted in the various churches. Sometimes we find the organ with congregational singing and a solitary precentor. Whatever method may be adopted, provision must be made for it, as the music is essentially a part of the service, or should be, and its location and source should be near the pulpit, whether back of it, above it or at one side.

The various parts of the service should be in sympathy and in communication during the devotional exercises. The congregation enjoy the service and are benefited thereby in direct proportion as they can hear and see the same to advantage.

In man's physical organization nature has indicated that what we see and hear to best advantage should be in front

and not at the back or the side; hence to avoid twisting and turning, the seats should squarely face all exercises of the speaker or choir. There is a magnetism in the eye, and an effect in pertinent gestures, combined with the mobility of the facial muscles, of which no speaker should be deprived and no congregation should lose. The platform should be large enough to accommodate all speakers on special occasions, and of such height and location as to bring the speaker in the very midst of his audience. If symmetry is desired, the organ should be located back of speaker either central or divided, and a mu-

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sical chorus should be arranged in terraces a little above and back of the pulpit platform. Should this symmetrical arrangement not be considered essential, a very advantageous arrangement is to locate the choir at one side and the organ at the other. This will provide an ample chancel or sanctuary, and the communion table may be located back of pulpit, thus saving or economizing space; thus the speaker will be enabled to address the choir or the congregation without turning. The *form* of the building should accommodate itself to this development with proper provision in the way of exits, entrances, vestibules and corridors.

The proportions of room should be such that the most remote portions should not be greater than the width of the main body of church facing the speaker, and the nearer the main body can be contained within a sector of ninety degrees the more advantageous will be the arrangement. Unless the church is built for pageants avoid the broad central aisle—the best location for seats—a source of annoyance to any sensitive speaker is to have the audience divided by a broad, vacant avenue, compelling

him to look two ways or address the divided halves alternately. To secure proper proportions and especially in larger churches, there will be an apparent waste of space in height, in proportion to that occupied; hence, by properly constructed galleries much additional seating capacity may be secured without increasing the dimensions of the building, thus placing the audience in layers.

The gallery should be located contiguous to the outer walls and largely over the corridors and outer avenues or passages,

should be as low as possible, without becoming oppressive to those seated under, be constructed in terraces with especial reference to sight lines and acoustics. *Properly constructed and proportioned*, a gallery is of advantage to the acoustic properties as well as the heating and ventilation of a building, otherwise a serious detriment. Stairways should be easy of ascent and convenient for access principally from vestibules; doors should be provided in order that galleries may be controlled in case it should be advisable not to occupy same. There should also be inner stairways connecting the galleries with the body of the church so that the various services of the church may be administered without passing out of the auditorium.

A very advantageous arrangement is obtained by connecting the choir gallery with the main gallery at each side of the pulpit by proper easements, thus forming a continuous gallery encircling the room. There must be wide outer doors both for convenience and for safety, properly located for distributing the audience, while for social reasons there should be a prominent entrance and commodious lobby where greetings may be exchanged, which to many is essentially a part of the service. Having thus demonstrated what the ideal Auditorium should be let us consider that next in importance, the Sunday School.

In the various denominations, with few if any exceptions, the Sunday School is now recognized as an integral part of the Church organization. As now developed, and especially in America, it is essentially a part of the church, held in buildings provided by the Church, sustained by funds collected in various ways from the supporters of the church, and organized and officered under its supervision, thus effectually a feeder of or nursery to the church. Properly organized the Sunday School must be treated in classes, and *en masse*. Subdivided into various classes the School will, if left alone, *grade itself* according to age and proficiency. The general plans for gradation are capable of an infinite variety of modifications. The idea should not be carried too far. The precision of method prevailing in secular schemes is often of disadvantage. Still some system of test, examination, promotion and gradation is essential. A suggested scheme for gradation is as follows: 1, Primary; 2, Intermediate; 3, Junior; 4, Senior; 5, Bible; 6, Normal; 7, Relief. A kindergarten class is frequently added for the smaller scholars. Various schools are making experiments and modifying their systems, seeking to find the perfect system of Sunday School gradations: the results are being watched with interest.

For the requirements of this service a specially constructed and arranged building is necessary. The Sunday School being a modern institution, there are no examples or traditions to govern, but we must plan and arrange the building as all buildings should be: especially adapted to the requirements of the service for which it is intended.

The Sunday School must be broken up into certain general divisions and some of these again subdivided into classes. These must be separated and isolated as much as possible for class exercises and assembled as one audience for general exercise or instruction: This change occurring two or three times in a single session should be effected quietly and quickly. To move the whole school would result in confusion, we therefore arrange the building to secure this change by other methods. The arrangement of plan best adapted has been found to be that of a central rotunda or auditorium, approximately of a semicircular form with added width equal to about one-fourth the radius. Thus in a theoretical room with thirty feet radius the length will be sixty feet and the width about thirty-eight feet, one side being semicircular. Adjoining the curve of wall or periphery are small alcoves or class rooms about ten in number. A second story of these alcoves is located directly over, the dimensions of these alcoves being regulated by the sizes of classes, and of height as low as possible to avoid high stairs and bring the school nearer together. Above the upper rooms light for the central rotunda may be secured by clerestory windows or skylight; the alcoves are separated by radiating partitions; omitting partitions and combining two or more rooms will accommodate larger classes, especially on the angles. The larger rooms obtained at angles are generally fitted for the Primary. Entrance vestibules are secured in the portion added to the semicircle at either side, in which are stairways to the second tier of class rooms, access to which is obtained by a balcony with a low open front; in some cases access is given to the class rooms on their outer wall, making a surrounding hallway. This is not always desirable, as it increases the dimensions of building and isolates the rooms from direct light and air.

The medium separating these small rooms from the central one is mainly by doors folding back against the side partitions; sometimes the rolling partition is employed, either vertical or horizontal, and sometimes doors operating vertically as sash, also by doors

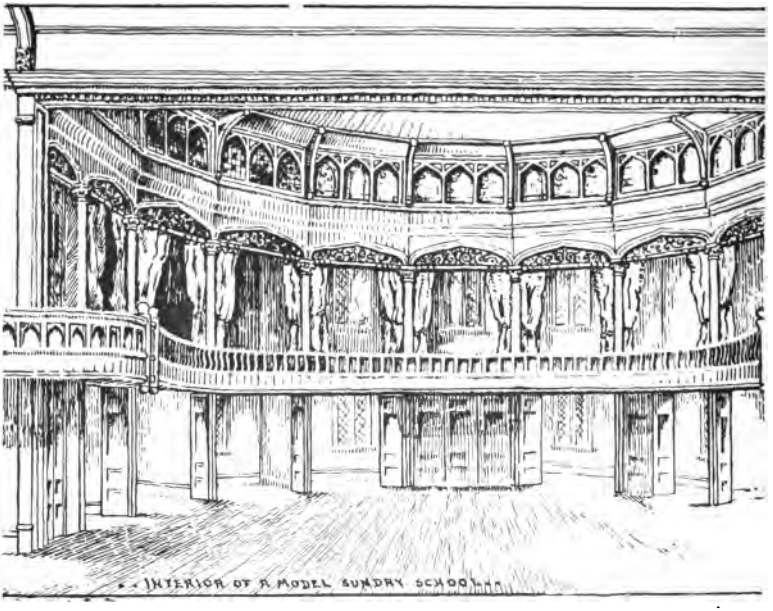
folding on themselves like a fire-screen, and in some cases portiere curtains. Folding doors are the most convenient for ingress and egress; also in that glass panels may be used for light and through which the superintendent and class may be visible to each other.

Doors to the lower tier are especially desirable from the fact that they secure isolation from the classes in rotunda, while above the gallery they may be omitted, there being no classes directly outside. For appearance and to aid the acoustic effects, portiere curtains are of advantage in the openings of the upper class-rooms. When the doors or openings are closed each alcove becomes a private class-room, and when open the whole becomes one large auditorium with a wide gallery encircling the outer wall. The change can be effected from one large public assembly to a score or more of small ones in a moment and without confusion.

The central part should be occupied by those who receive general instruction, generally subdivided into numerous classes occupying chairs grouped around tables. In the opening and closing exercises these small groups face the superintendent who occupies a platform located in the centre of the straight side, thus during the opening and closing exercises every member is in direct sight and hearing of the single speaker while during class exercises they are transformed into a collection of small companies entirely independent of one another. The relative proportions and arrangement varying according to the organization of the School, in some cases the lateral or radiating partitions are wholly or partly formed of sliding doors, thus rendering it possible to remove all subdivisions when and where desired. The location of Pastors or Bible Class, Library, etc., are determined by other arrangements, systems adopted, etc. Each class-room is often furnished with pictures, cabinet cases, etc.

In this peculiar arrangement the beauty that flows from utility is easily developed. The most matter-of-fact simplicity of construction will give an effective interior. The principle can be adapted to smaller or larger buildings than indicated with equal advantage. Various modifications are employed to meet the requirements of individual cases, with separate buildings in the more liberal instances. The dimensions, proportions, constructions, forms and materials to secure the most satisfactory result and properties, must be those determined by experience and experiment.

A third department of the church will probably be the chapel or lecture room for smaller meetings of the church, in connection with what may be called church parlors; if these can be so arranged as to be adjacent with ample intercommunication it will be of great advantage and if accessible to Sunday School rooms and so arranged as to combine all the better. Ample provision must be made for the various church Societies, as Christian Endeavor, Epworth League, King's Sons, King's Daughters, etc., etc. There should also be provided Reading rooms, which should be open every evening in connection with the library.



INTERIOR OF A MODEL SUNDAY SCHOOL ROOM

A cosy convenient study should be provided for the pastor, as well as an office for the various Boards in which should be constructed a fire-proof vault for church papers, etc. There should be an office for the Custodian of the Church—often an assistant pastor—located conveniently near the entrance where all callers or visitors could be received and matters of business arranged and referred to proper parties; smaller parlors or class rooms connecting will prove a great convenience, if possible.

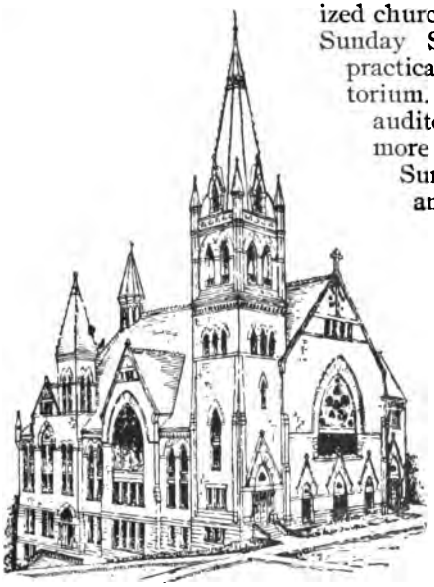
When possible a room or department for physical exercise is a valuable adjunct which may also serve as a drill-room for the boy's brigade or cadet corps. This room or the lecture room or parlors if properly located may also serve as a social-room in which tables may be placed, in connection with which will be required a kitchen with range, sink, hot and cold water, cupboards and all modern conveniences, also a general store room for surplus seats, tables, banners, decorations, Christmas fixings, etc., etc.

Thus the possible uses of the modern church edifice is practically only limited by the accommodation which can or may be

provided, and some idea formed of what is meant when speaking of the modern church as an Institution, all of which will be more fully considered as the Institutional Church.

There can be no question of the legitimate advantages derived from the various divisions of service, hence it is incumbent to provide to the extent possible for their accommodation. To provide for the entire list in a convenient manner will of course necessitate large complicated structures. To provide less will not be complete equipment for efficient Christian work. The list may be added to indefinitely, for there is no limit to the beneficent work which may be undertaken or the means employed in its execution.

The most economical arrangement is that by which certain apartments may be utilized for more than one purpose, when those purposes or times for service can be so arranged as not to conflict. Combinations may be effected whereby one larger room may be subdivided into smaller ones. For further economy, both in the construction of the building and as regards land, certain rooms may be placed over others. For convenience of access, to accommodate construction, and other reasons, the social departments adapt themselves best to the basement, with the auditoriums above. In properly organized churches the requirements of the Sunday School as to capacity are practically equal to that of the auditorium. The requirements of the auditorium as to capacity are more varied however than the Sunday School, as the attendance in fair weather may be double that of unpleasant. Special services may occasionally require double the fair weather accommodations, and if it is known that the capacity is limited, it will prevent attendance.



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The Sunday School is not subject to such variations. The growth or increase should be regular and ample provision made for it. The problem with the Auditorium however is, how best to accommodate the varying attendance. It is scarcely justifiable to erect with capacity equal to the special occasions; the expense of maintenance is much greater and the house will not be half filled four-fifths of the time in order to be adequate the other one-fifth. The depressing effect of a half filled house and a scattered audience, as compared with one well filled on both speaker and hearer is well known, hence some telescopic or elastic principle is essential whereby the room may be adapted to the size of the audience. This has led to the development of what is known

as the "combination" whereby one room is utilized to reinforce another. Thus by so locating the Sunday School department or the Lecture room in their relation to the Audience room as to properly combine, either room may be reinforced, to the extent of the capacity of the other. *To so plan and arrange two auditoriums that they may be perfect in themselves and their properties, and so combine them as to result in one perfect room in arrangement, convenience and inherent properties*, is a difficult problem, but *not impossible*. This will result in always being able to regulate the size of room to accommodate the audience, and people will attend knowing they can be accommodated.

The most generally adopted arrangement is the combination of Auditorium and Sunday School, the two departments being

practically of same size, renders it possible to double the capacity and preserve symmetry. Various other and additional combinations are employed and possible whereby the Auditorium may be increased two, three or even four times the original capacity without materially increasing distance from speaker, or locating any of the audience out of sight or hearing.

The services of the Primary department and the Bible or Advance classes not being identical with those of the Sunday School may be provided for in separate portions of the building. They should, if possible however, be connected so as to identify them with the school. Where economy is not the leading question a separate building for the Sunday School is of advantage, thus permitting of the greatest latitude in arrangement.

The same rule as to combinations and dual use of apartments should be considered throughout, providing closets, toilet rooms, and all the other various conveniences possible and essential to a complete building.

Thus it will be seen that to accommodate the modern church, the chief difficulty lies with the interior for which we have no adequate precedent or example. At the same time the church in all its varied departments must be cheerful and warm, its atmosphere fresh, pure and clean. There must be no possible condition of weariness and vexation by painful efforts to hear and see. Whatever is done in the way of heating, ventilating, lighting or decoration should be consistent, in harmony and such as will best minister to the comfort and welfare of the people.

The time was when the social element was frowned upon, but we take great pains to prepare amusements and entertainments at each other's homes; why not in the social rooms and work of the church, which is or should be a home on a large scale.

There is too much close corporation about our churches, and not enough home liberty and common sense. It is far better to have an eye on the young when undergoing temptation, and a part in shaping their entertainment, than to send or allow them to seek it elsewhere, and possibly become morally responsible for their failure or fall.

It must not be understood that the practical development of the "Ideal Church, Institution or Combination" will result in some fixed plan or system larger or smaller according to its requirements; the common sense principles involved, which should be incorporated in some form or combination to be of greatest advantage, only have been demonstrated. The various arrangements and combinations which may be employed or adopted are practically innumerable. All should be based however on these principles, various applications or adaptations of which are indicated by the plans accompanying. The great advantage derived from first arranging or determining the requirements and plan of a new church edifice is thus readily seen, and how an ill-shaped or insufficient location may sometimes render it impossible to erect such an edifice as may be desired, resulting in such dissatisfaction and lack of interest and facilities as to be an actual hindrance to the cause, while in the hands of an experienced man with many resources, adaptations may be made of advantage to almost any location or condition. Still there are conditions possible in which their practical consideration is not advisable.

All matters must be carefully considered as to requirements, both for present and future needs, and the various departments to be accommodated or provided for; the arrangements of advantage or necessity, whether the Sunday School shall be located in basement or on a level with auditorium and the extent of provision for social or institutional work, all with due consideration to the growth of the church in numbers as well as a possible future change in policy or system.

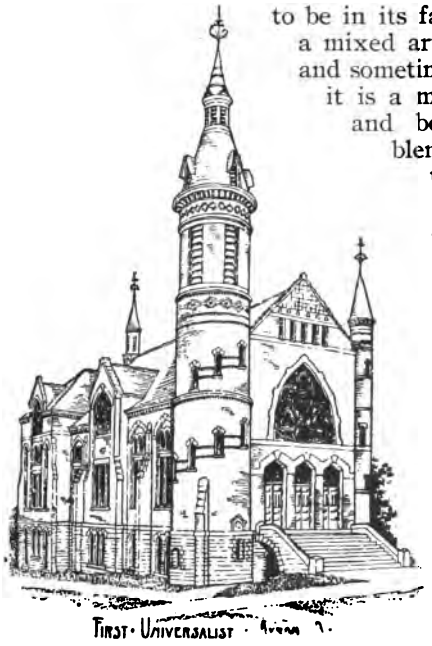
Do not compel future adherence to present ideas or principles by restricting conditions, as the work of the church must keep pace with the times or be crippled in its efficiency. Note how we are hampered with the buildings of fifty years ago; what will the next fifty bring forth? We must conscientiously *build for the future*, not for the past or even the present. Having thus ascer-

tained in a way what the modern church should be in plan and arrangement the site should be secured, that which is available or best adapted, and then a plan definitely determined which will give form to the proposed edifice. The church may possess one; due consideration as to the location and dimensions must be given before determining whether to utilize it or select another. The church should not be located on a back street or out-of-the-way place. It should be as much as possible in the centre of influence and location, easy of access; some prominent street corner if possible, not where most accessible or where the work is easiest done, but with reference to the greatest efficiency in connection with the work to be done. Sentiment should not be allowed to dictate in reference to occupying the old site. Conditions may have largely changed since first adopting the location, and aside

from the simple fact of association, may be the worst site available. These questions all determined in a satisfactory manner, we must next consider the exterior.

Illogical attempts have been made to secure a quite new type of interior at the same time preserving the exterior of the old type. Only repeated unsuccessful attempts will prove how illogical they are, and how illogical it is to disassociate the practical from the expressional artistic side of any art.

There is a point of difference which marks off Architecture from the other Arts and is commonly held to be in its favor. Emerson says: "It is a mixed art whose end is sometimes use and sometimes beauty;" more correctly, it is a mixed art whose ends are use and beauty interwoven, and this blending of the utilitarian with the strictly esthetic insures us that men will always build although they may cease to carve, or paint or sing. Looking at the works produced where artistic instinct has been lost and groping or mistaken aspirations have tried to play its part, and remembering that the world cannot so easily with the advent of better taste rid itself of the Architect's, as of the Painter's or Sculptor's legacy of failure, we may feel perhaps that it would be better if the art at times could cease entirely, could die to effort as it does to success. But as no theoretical decision as to what might be for the best can alter the fact that building must go on and as we know that its results are the most permanent of man's creations, it is evident that in no art whatever have we so vital an interest as this.

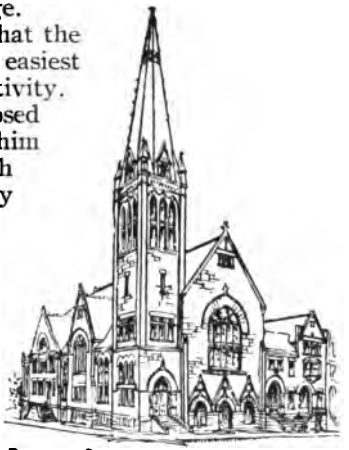


First Universalist

With no art is it so essential that the people at large should be sufficiently enlightened to distinguish good work from bad, and to encourage the good by public as well as by private approval.

Doubly is this the case since no art is so dependent upon patronage. The result of ignorance does not as with the other arts mean apathy or the loss of possible delight, but means the multiplication of wretched works that must remain to disgrace the memory of their generation and corrupt the taste of later comers. If it were clearly perceived by the public that there is much good building going on, and if it were more evidently distinguished from the bad flourishing beside it there would be less excuse for criticism.

That this bad work does so rashly flourish is by itself sufficient proof of a wide-spread deficiency of knowledge, since architecture always comes in answer to a distinct call of patronage.



PREMIATED DESIGN · SIXTH AVE.·M.E.· BROOKLYN.N.Y.

It is too general an idea that the Ecclesiastical work must be the easiest part of a modern architect's activity. It is still too commonly supposed that the medieval styles offer him a multitude of models which exactly copied or but slightly modified will answer all his purposes. That he must be able to imitate discreetly and skillfully but need give no thought to the fundamental problems of his art, since these were fully worked out in the past and settled once and for all, a belief which awhile ago was almost superstitious in its protests against the use of any other style or the desirability of modern innovation.

Gothic art died with the supremacy of the Catholic Church. As the various Classic fashions have succeeded one another each in turn has been used for ecclesiastical as well as secular constructions.

In the Seventeenth Century the genius of Wren wrought practical fitness and often structural though not decorative beauty out of elements then in favor. Later the Pseudo Greek Temple was in vogue. No good end was attained, then came the Gothic revival bringing change where change was sadly needed. Its results however were not of unmixed good,

for reason and common sense were ostracised from its early counsels.

The newly recognized beauty of medieval work so intoxicated a generation that had been fed on the dry pabulum of classic nullities, that its eyes were blinded to the change which had come over practical requirements, or else persuaded that this change was a misfortune to be deplored and disregarded.

Many of Wren's churches were more appropriate to current needs than those of earlier days, but his inventions were despised and a distinctive backward step taken, the pernicious doctrine being taught that Architectural "Art" need not concern itself with matters of fitness or veracity.

For a while this view was accepted in America as implicitly as in England, but with less excuse. With the established church

preëminent, far less change has come in practical or expressional necessities, than where as with us, the majority of the people belong to the more extreme Protestant Communions. Of late the belief in the entire adequacy of an imitated medieval art to meet the strictly modern needs is neither so universal or implicit as it was; not that Gothic art is to be abandoned or some new style brought forth, but rather that selection of the fittest which belongs to Eclecticism. The Architectural design of any building depends largely on the materials employed in its construction, these depending on taste, availability and expense, and to a certain extent should be in harmony with the environment and latitude. The righteous use of style in connection with material is likewise an essential, always observing however that there is no "sacred style" to which all things ecclesiastical must conform,

no matter how cheap the material, how limited the resources, how feeble the skill or shallow the pretense, shams and affectations, such as stone buttresses made of wood, crowned with sheet iron head-dresses of a strange device, all useless and inconsistent, as well as stained-glass windows made of paper, must be avoided. Another common fault in otherwise excellent designs is combinations of materials and designs, faultless in themselves, but of inconsistent combinations and strongly contrasting colors. A proper selection and harmony of material and color is as essential to give character to any building as the architectural style.

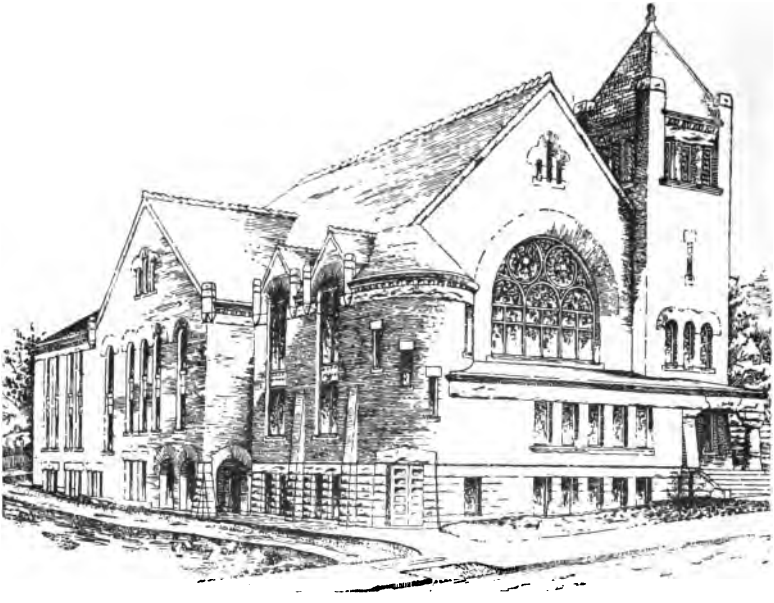
There should be absolute truth in material, design and motive. In the selection of stone, color effect should be a consideration; with a wooden building paint or its equivalent is essential. In brick or terra-cotta a selection of all the various shades of color appropriate is now possible, while with common brick, paint is of advantage both as to appearance and durability. The right use and true value of color are rarely understood and paint and color are therefore liable to destroy as well as improve. There is really no good excuse for the existence of these shams and incongruities. They are not only unnecessary, but in new buildings are ridiculous and culpable, as under the guidance of cultivated taste and skill which can always be obtained they are impossible.

Architectural forms appropriate in stone are clearly inappropriate in other materials; wood for instance, and have no structural merit or beauty of form if executed of any other material. The converse is equally true.

The particular style of Architectural design being determined by methods heretofore referred to, details which are not strictly essential but consistent, may be determined by individual taste, preferment or expediency. Under this category may be considered large, cheerful porches wide enough to afford shelter. Towers or spires for bells, chimes, clocks, etc., and domes for central lighting all serve a purpose. The almost universal association of the tower or spire with the church, renders it in the minds of many an indispensable and distinguishing ecclesiastical feature, lending emphasis and character to design. There is much worthy of consideration in connection with this sentiment. The design however of any specially emphatic feature should be the result of study, earnest and devout. Towers belong to the earlier stages of growth and lack somewhat the refinement of spires, but whether tower or spire, adhere to honesty in construction and consistency in design, as this is the index to the character of

building and will stand for ages against the background of the sky, a solemn declaration of faith in God and hope of heaven.

Whether the appropriate and dignified style can best be secured by following the best examples of existing Church Architecture, which by their hallowed associations excite profound and reverend emotions, or deviating from these examples, adapting our work to our circumstances and practical needs, and adopting an eclectic style wherein we appropriate whatever is desirable or of advantage, and wherever found, consistently blending into a harmonious design is still an open question.



We find a progressive and conservative element in Ecclesiastical Architecture as well as in theology. Among the progressives may be found a bold reformer who is ready to bury the past, ignore precedent, and press forward to an Architectural dispensation entirely new. In all this, is not the middle course the proper and safe one? Is not Christianity forever old and always new? Is it not the same yesterday, to-day and forever? Should we not rather stand ready to accept and adopt from the past whatever will best serve our purposes, not that we may become its servants or servile imitators, but that it may serve us?

If it is proposed to give scope to all the possible uses of the Church and provide for the same as previously indicated, it would be well in this connection, before proceeding further, to consider the "INSTITUTIONAL, SOCIAL OR PEOPLE'S CHURCH," and what are its peculiar requirements. Considering the Church as an institution, designed to attract the attention of men in the community and lead them to certain courses of life and development, we see that it is surrounded by a great number of other institutions or influences, some friendly, some rival, and some hostile to its objects. In certain necessary parts of its work the church comes in competition with organizations that tend to lead men in the opposite direction.

The success of Association buildings which young men have established in our large cities, show that property can be used to advantage every day in the week for the cause of religion. In many a locality the churches are closed and locked from Sunday to Sunday, and there is not a well adapted and attractive place to gather the people for a convention, concert, lecture, anniversary or union meeting of any sort. While there may be prejudices, sentiments or a feeling that the Church should be sacred to express and formal worship and the ceremonies of devotion, provision can be made for the accommodation of all these agencies other than the church proper, thus preserving the sanctity of this portion of the edifice.

The Institutional Church is the exponent of Christ going about ministering and doing good, preaching, teaching and healing. The theory on which it is based is that every member should do something. The work of the church has grown. First, the church was to preach in, then became a place to preach and teach Sunday School, then the Endeavor Society and League work was added. The introduction of Institutional methods will change it more than all others combined.

The educational work begins with the night school. All common branches are first taught, then industrial, cooking, housekeeping, general sewing, dressmaking, business courses, scientific courses, art courses, and a training school for nurses are gradually added, first with volunteer teachers, later with paid help.

A kindergarten will be provided to counteract the many influences which distract the attention of the young from the Sunday School. In many ways it reaches the home and should; improvement of the home and conditions make better citizens. First impressions are the lasting ones. To teach the young and

enable them to form correct habits is the true work, and not allow them to form character without guidance or influence and later endeavor to convert them from their evil ways; it is far easier to *grow* Christians than to *make* them. Proper influence and teaching extended to *all* the children would redeem the world in a generation, hence the legitimate work of the church should be in the direction of the young. These schools should do for Protestant children what the Parochial schools do for the Catholic.

The Institutional church may start out at first on a small scale with a night class only. Soon others are added until there

are classes of some kind for every night of the week taught by some member; this may develop into a college with professors.

The Institutional church employs Deacons and deaconesses who regularly visit the sick and minister to them, thus doing the work of the lodge. Service may at first be gratuitous, later with increased ability employing professional nurses as they do a Pastor. Later will come dispensary work starting with a small stock of medicines, with certain hours devoted by various physicians who will be glad to help the church and humanity; this will all gradually grow into a hospital without intent.

With increasing interest and demand, a reading room should be added provided with a library, bureau of information, societies of a literary and social character will be formed, counteracting

club life, thus supplying all the advantages of lodge and club without the secrets or other objectionable features.

In connection with all this a Gymnasium with all its adjuncts will be necessary.

Rescue work with accommodations for temporarily housing the homeless, also may become a place where young men or women in a city without a home may find the comforts and welcome of one, and may thus save them from many a temptation. The question may be asked, why do all this work? As to the night schools, most young people must make their own living in some way, in stores, factories, shops, offices, etc., to whom the free night school offers the only opportunity for

education or improvement. Many have neglected early opportunities who would gladly avail themselves if they do not have to go to primary schools with small children. Sewing and cooking schools afford opportunities for poor girls who have no other. These girls are to be the mothers of the next generation; sewing and cooking have much to do with homes; better homes, better children, etc.

Many worthy poor suffer for medicine and care, who cannot afford them and physicians are willing but cannot spare the time. By thus systematically arranging time and place the two may be brought together and much good accomplished. The Deaconess home should administer to the practical charities of

the church and go like Sisters of Mercy. The heart responds to kindness to body and mind and can thus be readily touched.

Habits of thrift should be encouraged, thus the addition of a Savings Bank would greatly help the young to be steady, economical and saving. Might also act as purchasing agent for coal and other supplies, buying at wholesale prices and dealing to members at cost. Thus it will be seen that the possibilities of the Institutional Church are unlimited and susceptible of great development. Care should be observed however that antagonistic influences or feelings are not created by infringing in legitimate lines of business, and should not be conducted for profit other than necessary to aid in charities or to pay expenses.

The Institutional church properly located and managed, may thus grow to become the centre of every good thing in a community, doing good at all hours of the day or night for seven days of the week, increasing in momentum and receiving the ready response of the community. The absolute necessity of providing *proper accommodations* for these varied requirements, if contemplated, is apparent. Buildings cannot be increased or added to economically or advantageously as the work develops, therefore in erecting new buildings future work should be anticipated. With existing buildings economical and advantageous adaptation must be considered, as the success of the work depends largely on the conveniences and facilities for practical, economical administration as well as the personnel of those in charge.

CHAPTER IV.

HOW.

THE ARCHITECT, HIS WORK AND RELATION TO CLIENT.

HE Architect is the recognized head of the building trade. He is supposed to be especially skilled in the art of planning and designing architectural structures of every description. His duty is to draw plans,* make out specifications and to generally superintend the execution of the work. Not only is he required to possess great artistic skill in designing but a practical knowledge of all the details of building. He is generally required to furnish in addition to the general design, working drawings to guide the artificers in constructing the building. To prepare proper specifications requires thought, experience and learning, for he must be familiar with the qualities, properties, peculiarities and strength of materials, the weight of structures and the relationship of the various operations to be performed by the many trades represented in the building. He must be a man of resources and equal to emergencies.

The modern Architect must be up to the times; he must be a constructional, a heating and ventilating, a sanitary and an electrical engineer and must also be an artist to clothe the forms of his creation with an exterior design of correct architectural proportion and æsthetic beauty, to decorate the construction and interior, by directing the artists who with chisel and brush make the marvelous creation a thing of beauty and a joy-we trust-forever. The ability to successfully accomplish all this is possessed by few and is only a result of long years of successful experience obtained from long and extended practice.

A person following the occupation of forming plans, drawings and specifications for building purposes representing himself

* The word is used in its generic sense and includes all kinds of Architectural drawings required in building operations.

as an architect is presumed in law, not only as being such but to be learned in the profession. Unfortunately the public have not with the Architect the same safeguards against imposition, that exist with other professions. The Attorney must pass an examination, before admission to the bar. The Physician must have his Diploma and License, and the Minister must be qualified and ordained, but no examination, license, or any qualification is *legally* necessary to constitute an Architect. The law will permit any one to hang out his shingle, call himself an architect, and the law presumes he is. The only way of showing his competency in evidence is to prove that he acted as other competent architects would have done. The only safe guide in selection is the experience, reputation and demonstrated ability of the man.

It is well to consider the peculiar relations of owner and architect especially in superintending, which is that of principal and

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agent, to a certain extent differing from that of other professional men. Two qualifications are eminently essential, *integrity* and *ability*. While the architect is possessed of the recognized powers to legally bind the principal, the principal is equally responsible for his neglect. He cannot legally delegate his authority and his contract does not survive to his successor without consent.

An architect is employed as an expert in all matters pertaining to building. The interests of the client should be his interests. In this capacity and with this latitude only can the best work be done. To obtain the best results he should be familiar with all the various requirements of his client and his ability to meet expenses; and should enjoy the same confidence extended to the physician or attorney in their relations. The

architect serves the client [illegible]
works for his client [illegible]
interested in the out[illegible]

It is not a confession [illegible]
to defer these matters [illegible]
expert. The folly and [illegible]
disgrace would be [illegible]
themselves or plead their own [illegible]
the services of the best [illegible]
integrity and with such [illegible]
sonally unknown [illegible]
and confidingly entrusted [illegible]
interests. If you [illegible]
results do not [illegible]
or hamper his hands [illegible]
desires and insist [illegible]
what they are yourself [illegible]
problem in his own way.

Can such service be obtained [illegible] by resorting to competition? [illegible] selecting an architect or [illegible] in this method it matters [illegible] not rather every inducement [illegible] more inefficient and incompetent [illegible] hide behind finely executed [illegible] which only represent the talent [illegible] bly no thought of his. The [illegible] to catch the inexperienced [illegible] the work in execution have [illegible] almost every enterprise in which professional service has been selected or determined in this way.

Open unpaid competitions are an abomination. It is worse than folly to expect to secure the best ideas of the *best* men for nothing. It is only when the proper relations exist that the true architect will expose his best ideas and *resources* which are his *capital* in business.

Any man's reputation is an open book; it is easily ascertained if he has one. His moral standing, character and personnel should also be considered on account of the intimate relation which should be sustained. While much may be said concerning the Architect and his duties

and obligations, on the other side but little is said of the *client's duties and obligations*, although gross disregard of them may be now and then condemned in the law courts, their existence is scarcely recognized as yet by the National Conscience.

When the undertaking of actual work is in question, it is no exaggeration to say that the architects are approached in an attitude of self defense, are often grudged their just rewards, are sometimes asked to work without reward and are accused of a desire to overreach, when in fact the effort is made to overreach them.

Of no other profession would such words be true; yet the profession itself should not be held responsible. None has a fairer, cleaner record in the eyes of those who know the rights and wrongs of its condition. None is more laborious, none does the country more credit; all things considered in the results of its work and none can with less justice be called overpaid.

The public well know what the doctors can do and they are asked to do no more nor less. They know also what they must pay them and pay without protest. Only fools think they can do without their services or expect them never to make mistakes, or permit amateur interference with their decrees. It is the same with the law and the same with engineering which comes so close

to architecture, but when the dividing line is passed and the *artist* is approached, the public do not know just what he can do or how he does it, or recognize their incompetency to help him, consequently ask him to satisfy impossible desires. Now to be infallible and now to suppress himself and follow their lead, and again suspect him of dishonesty because he works for a commission regulated by the cost of the building he erects.

FIRST · PRESBYTERIAN · ASHLAND·O·

Are doctors considered dishonest because the more visits the more pay? Compare the expense of conducting a large Architectural practice with that of other professions. A physician may manage a large practice with a plant consisting of a small office, a horse and gig, a single assistant and a boy to attend the door.

A lawyer's needs are but little greater, but what are the Architect's needs? It may seem simple work to the public to *merely* design on paper and *merely* supervise the erection by contractors who do all the work, but to design means to prepare, not only all the little sketches and plans a client sees, but many large scale and full size drawings, requiring much time for elaboration and not only artistic reflection but long and complicated mathematical and preliminary calculations as well, and to supervise means frequent and extended visits from the Architect or competent assistant. All this implies varied and extended knowledge and experience. He must be familiar with all trades and branches, competent to direct and pass on all classes of work, thoroughly familiar with all materials and processes as well as the latest improvements, and must pass on their advisability. Considered chief of all persons engaged in building business, he must depend upon his own resources and be prepared for all emergencies having

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no one to look to for aid. All this implies continual study, expensive library, well lighted offices, a numerous corps of assistants, some of them must be men of great skill, ability and experience and frequent visits to distant localities, investigations and experiments that are all expensive.

The fact then remains that when he receives the largest commission on the most expensive buildings it will bring him a net reward so disproportionate to that secured by an equal amount and quality of labor in other professions that he may be ranked with the clergy in being the least paid of any professional men.

The time was when one person could learn and know all there was known of the several professions and sciences, but the day has already passed when one man can be preacher, editor, teacher, professor and possibly family doctor. It will soon be here when each one who worthily fills any one of these positions will be reinforced by a corps of assistants whose specialties will multiply the fruits of his efforts in a geometric ratio. As knowledge extends men confine themselves to one occupation or profession until now as a result of investigation experiment and improvement it is impossible for any one to acquire a thorough knowledge of even one profession or calling.

In consequence, to become proficient men become specialists, giving attention to only one branch of a calling or profession: thus we have in the legal, medical and all other professions the specialist whose services are always sought in critical cases or when the best results are desired.

It is evident that the services of anyone who devotes his entire time to one department or branch of any science or profession should be of far more value in that special department than that of the general practitioner. The demonstration of the fact is verified by the success and reputation of the specialist.

Ecclesiastical Architecture is or should be a thing by itself having its own characteristics involving questions of tradition and the evolution of religious thought, not only brought about by conforming to the present modes of worship as affected by the various sects, but by the changes wrought by a more universal education and greater freedom of thought on religious subjects.

The separation of Ecclesiastical from all other classes of architecture will necessitate the services of an architect who is a specialist to secure the best results.

It is a lamentable fact that the larger proportion of the churches of this country are the least satisfactory architecturally

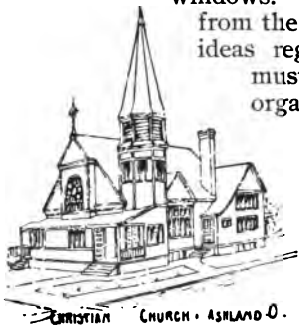
considered of any class of buildings. Many are excellent examples of what does *not* constitute good architecture.

The reason of this is plain enough. Most Protestant Churches are built under the direction of a building committee composed of members of the Church, good men in their way and place, who without any special training or even preliminary study undertake to dictate to and direct the selected architect so that the developed plans represent *their* ideas rather than those of the experienced architect. These same parties would not pursue such unbusiness-like methods in their private business or in the employ of other professions. There is no situation in which the wisdom that pertains to the children of the world shines more brightly in

comparison with that of the children of light than in matters of worldly business belonging to church organizations.

The Architect should be selected to give his ideas and his conception of what the church should be, after ascertaining *all requirements and conditions;* not merely try to prepare drawings which shall accord with the tastes and opinions of the Committee, which may be that the edifice shall surpass all others in size and splendor and not be a "reproach to the society."

Many members *not* of the Building Committee will impose conditions; Bro. A. will give—conditional that there is a stone spire 10 feet higher than that on the *Hopewell* Church. Bro. B., must have unapproachable stained glass and stone tracery in the windows. Bro. C., must have a stone church from the *Rockland* quarries. Bro. D., has special ideas regarding frescoing and decoration and must dictate that. Bro. E., knows all about organs. Bro. F., has some special ideas about pews and cushions that must be incorporated. Bro. G., has a friend, who although not experienced, knows all about the theory of heating and ventilation. Deacon H., has a promising nephew who has a predilection for Architecture and at some time made a stunning picture of a church; this is his opportunity. Everyone of the brethren to the end of the alphabet has an equal right to have his pet idea theory or admiration introduced or he "won't play."



The result, if consideration is given to all of these ideas and opinions, had best be imagined. It will be an inconsistent, nondescript, whose sole claim to sacred consideration is that it is not "like unto anything that is in the heaven above or that is in the earth beneath, or that is in the water under the earth," therefore its worship is not a violation of the sacred commandment. This architectural medley, a violation of all good taste would not be possible if an architect of skill were employed in whom all had confidence, and given proper latitude when the result would indicate that *one master mind* had designed and planned all, so that when complete every detail would be a well balanced part of one grand whole, and harmony, truth and purity combined with consistency would prevail throughout.

CHAPTER V.

NOW.

THE PAPER CHURCH.—THE FIRST TANGIBLE FORM.

ALL who have had any experience in building operations, know the importance and advantage of having an accurate, graphic delineation of the proposed edifice for consideration and guidance, and the difficulty without such aid of giving adequate attention to all the innumerable points of construction and arrangement, all of which must receive attention before assuming the definite form of the building, when changes are inconvenient or impossible.

There are few with experience who cannot recall instances of vexatious mistakes, costly alterations or buildings left insecure through want of proper attention at this, the critical stage. It often happens and should, that those in charge or some of them, have formed *a priori* an ideal of what the result should be, either in plan or design, and which is found impractical in actual construction. A careful graphical analysis should avoid all such results.

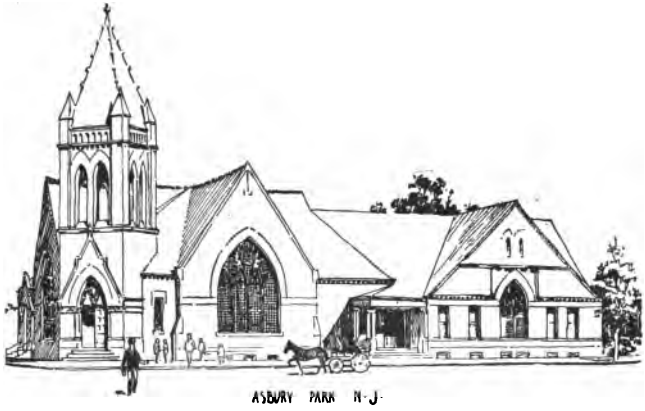
Architectural drawings are usually the delineation of bodies by orthographic projection, the representation on paper of forms having two dimensions only, length and width, and on such scales that dimensions can be taken from the parts and structures erected therefrom. Not only are these essential to the building operations, but also to the preliminary consideration and study, as without these material aids and graphic descriptions, ideas cannot be conveyed to the people.

If we proceed to take to pieces or analyze the architectural design or graphical representation of our ideas in relative proportion, we find that it consists of four parts; First,—arranging the plan; second,—carrying up the boundary and divisional lines of this plan thus forming walls; third,—the method of covering in

the space thus enclosed, and fourth,— the details of ornamentation which give to it the last and concluding grace and finish.

All buildings consist of a collection of enclosed spaces, marked out, determined and arranged for certain specific purposes. The first thing is to arrange these spaces — determined by the requirements — on the ground so that they may conveniently meet the necessary requirements of the building.

It may be of benefit to those who are unacquainted with architectural procedure in delineating architecture by geometrical drawings, to take this opportunity of illustrating briefly the philosophy of plan elevation and section, which many non-professional people seem to find difficulty in understanding. It must be remembered that the object of Architectural drawing is



not to show a picture of the building, but to enable the designer to put together his design accurately in all its parts according to scale, thus determining its *practicability*, and to convey intelligible and precise information to those who have to erect the building.

The Graphic is a universal language, by which ideas can be conveyed — by means of lines — almost inexplainable by ordinary language, especially to those uneducated in technical terms, and which can be readily comprehended by those who do not even understand a word of the language used.

The *rationale* of the Architect's geometrical drawings is that on them each plane of the building — the plan, the front, the side, etc.,— is shown separately and without distortion, every position supposed to be opposite the eye at once, and only length

and breadth considered; sloping surfaces and all projections appear flat, the incline of a roof and other dimensions known as the third dimension can only be ascertained by comparison with other drawings.

A *plan* is a horizontal section of a building indicating the shape of the walls with the upper portion removed; the eye is supposed to look down from above and is generally taken at such location that the section cuts through all doors and windows. A separate *plan* is essential for each separate story or stage of the building, unless they are duplicates. A *roof plan* represents

the roof as a flat surface viewed from above, while a *ceiling plan* properly represented shows the ceiling viewed from below. *Constructional plans* indicate the several plans, with the roof, ceiling or floor surfaces removed, showing all constructional members in position.

A *plan* in an Architectural sense is an idea or invention, a form of artistic and economic arrangement of spaces. The first thing an architect has to do is to arrange the spaces so that they may conveniently meet the essential requirements of the building; convenience and practical usefulness come first, but something

more than mere convenience must be considered. *Economy* and *practicability* of execution must be constantly in mind. No truly architectural intellect will ever arrange a *plan* without seeing in his mind's eye the *superstructure* which he intends to erect upon it.

The second step then is the representation of the enclosing walls called *elevations*, generally consisting of four, representing the four sides of the contemplated building as four planes, complicated buildings or special features sometimes requiring more. These representations of enclosing walls must be made with reference to the interior arrangement of *plan* on the several stages, and must be given architectural expression arising from the placing and grouping of openings, the relation of voids to solids, the proper emphasizing of the base and cornice and the horizontal stages of the structure, with the roof — of proper form and design — scientifically seated on the walls.

The *elevations* however do not tell us what is inside of the building, the *plan* only indicates arrangements while the *cross sections* indicate the building cut in two at some given location and shows the ends of walls occurring at that vertical plane, with height, depth and location of openings, thickness of floors, height of stories, form of ceiling, etc. Two *sections* are generally essential, the *longitudinal* and *transverse;* when not taken at the centre of building or not occurring on one plane, the location of *section* is generally indicated by dotted or red lines on plan; *partial sections* are sometimes given to indicate special features. The *plan* however is really the essential or *vis-viva* of every properly conceived structure. In arranging the *plan*, — in most instances, — some one compartment is of paramount importance; the interior must be arranged so that this most important compartment shall be the climax of the *plan*. The purposes for which the various compartments are to be used necessitate the consideration of the relative juxtaposition of same, exposure as concerns light and air, convenience of access, are largely factors, the entrances and connection with subsidiary compartments must be kept subordinate,

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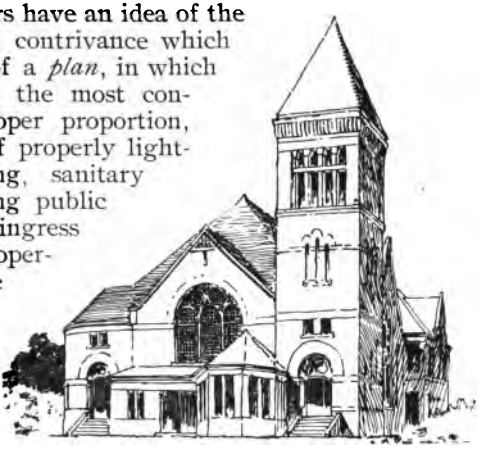
and convenient. All should lead up to the main compartment, the centre and *raison d'ètre* of the whole. It sometimes causes endless trouble to secure the proper arrangement — all practical,— but every *plan* so to speak must have some backbone to it. Few outsiders have an idea of the amount of thought and contrivance which goes to the production of a *plan*, in which all departments are in the most convenient position, of proper proportion, with all the essentials of properly lighting, heating, ventilating, sanitary arrangements as affecting public health, etc., considered; ingress and egress ample and properly distributed, and if the building is to be of more than one story, walls and supports properly occurring over one another, ample stairways provided, and all economically and constructionally possible and practical;



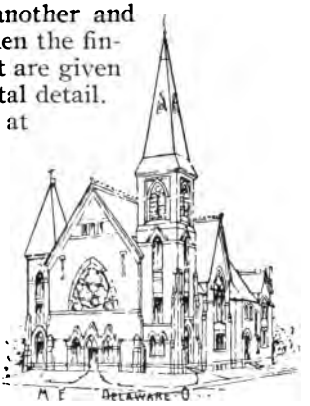
The important problem of covering over the space and the form and method must be foreseen and provided for from the outset, largely influencing the *plan*. The character of roof must be determined, whether a so called self supporting roof, in which only a vertical pressure is exerted or whether an outward pressure must be provided for.

The weight of the building must be considered, foundation and walls properly proportioned so that there may be an equal pressure per square foot on all foundations, which will require walls and foundations of varying thickness.

The strength and character of all materials must be considered, and such determined as shall best serve the several purposes. Massive columns or piers when objectionable must be dispensed with, wood, masonry or steel construction determined for various parts as best adapted, and

properly combined; openings in walls located where they will least weaken them.

After all these main features and essentials are determined logically and in accordance with one another and with the leading idea of the building, then the finishing touches of expression and interest are given by well designed, effective and ornamental detail.



Ornament should not be placed at haphazard, simply because pretty; everything in architectural design is relative, and must be considered in relation to the expression and design of the whole. Ornament must only be placed where it will emphasize certain parts or features; it must form a part of the grouping and refer to a central or predominating idea.

All architecture should be an organized whole, of which every part has its relation to the rest and from which no feature can be removed without impairing the unity or consistency of the design. A building may be good and expressive without any ornament, but misplaced ornament is only an excrescence on the design, not an organic portion of it.

The principal characteristic of a good *design* or *plan* is that it shall appear as if it were a natural and inevitable arrangement. Complicated *plans* are the easiest made because the arranging of them is practically doing as you please.

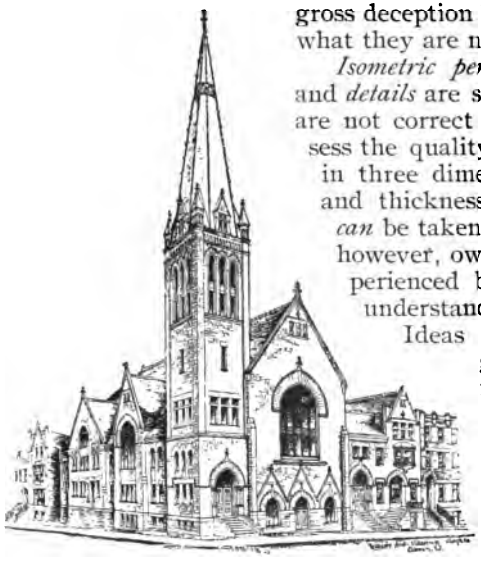
The apparently simple and natural *plan* is that which springs from much thought and contrivance.

An idea can thus be formed of the processes of thought and reasoning essential in connection with every line drawn in producing a practical, satisfactory *plan* and will demonstrate the necessity of skill and experience.

Other drawings than those heretofore referred to are made by the Architect,—such as the *perspective*—which is a geometrically, correctly drawn picture of a building as it will appear to the eye as viewed from a certain location. While accurate measures and a definite *plan* are necessary in producing a *perspective*, no measures can be taken therefrom except by a long process of projection and calculation, with some single dimension as a key or basis. At the best a geometrical *perspective* is hard and stiff and always appears distorted as compared with the building itself.

Perspectives in color are much more effective, in that color appears as a factor for consideration in connection with design which is proper and essential.

Perspectives are generally made preliminary to other drawings, and owing to the fact that measurements cannot be taken from them are often made the vehicle of gross deception by making things appear what they are not.



Isometric perspectives, *sections*, *plans* and *details* are sometimes made. These are not correct representations, but possess the quality of representing things in three dimensions, length, breadth and thickness, from which measures *can* be taken. They are rarely used, however, owing to the difficulty experienced by the unprofessional in understanding them.

Ideas having now taken tangible, preservable form in which they may be compared and considered, we are for the first time able to ascertain definitely as regards the cost of construction which is an essential, possibly *the* essential factor of the contemplated enterprise.

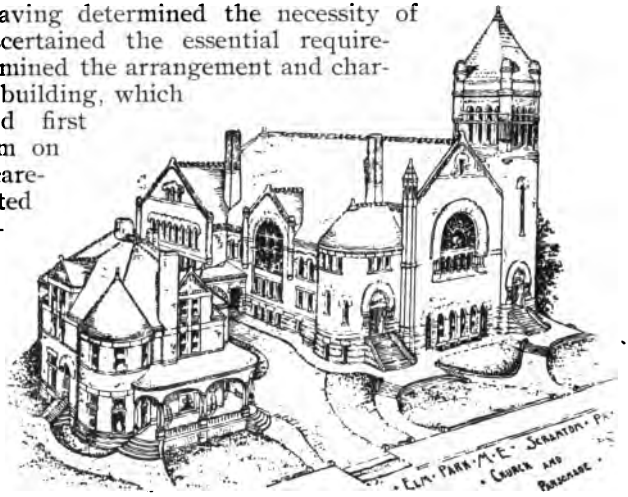
Shakespeare aptly sums the processes up as follows: — in Henry IV, Part II,—Act I,— Scene III.

> " . . . When we mean to build
> We first survey the plot, then draw the model;
> And when we see the figure of the house,
> Then must we rate the cost of the erection;
> Which if we find outweighs ability,
> What do we then, but draw anew the model
> In fewer offices; or at least desist
> To build at all? . . . "

The correctness of the principle is further demonstrated by divine precept; see Luke XIV, 28, 29, 30. "For which of you intending to build a tower, sitteth not down first and counteth the cost, whether he have sufficient to finish it? lest haply after

he hath laid the foundation and is not able to finish it, all that behold it begin to mock him saying, 'This man began to build and was not able to finish.'"

Thus having determined the necessity of building, ascertained the essential requirements, determined the arrangement and character of the building, which has assumed first tangible form on paper, and carefully computed cost, the question can now be definitely determined, as to *ability*. If this is exceeded, retrenchment is possible and modifications of the plans necessary; the next step being the obligations of contracts, an error committed at this stage becomes a fatal error.



Heretofore the enterprise has been prospective and ideals created. Once the matters are definitely determined and contracts made, we deal with stern facts and the ideal becomes real.

CHAPTER VI.

PRACTICAL.

IDEALITY VS. REALITY — THE CONTRACTORS, ARTISANS AND ARTISTS.

IN the consideration of processes, the stage is now reached when obligations must be assumed and when the various contractors and material men appear and must be dealt with. In the various preliminary proceedings changes were possible, as new opinions and ideas may be incorporated in arrangement of plan or design without serious results, but once these matters are determined and definitely embodied in the various drawings and specifications, and contracts let based thereon, every deviation means added cost and trouble.

A *contract* is an agreement between two or more persons or parties for a valuable consideration, to do or not to do some particular thing, and when it refers to constructing, erecting or repairing an edifice or other work of Architecture, it is called a *building contract*. In all work for which an architect has been employed to prepare the necessary drawings and specifications, they should be *prepared*, *approved* and *adopted precedent* to the making of contracts. As the drawings and specifications are considered as a part of every building contract and of equal force, showing what is to be done by the one party, all provisions, conditions or agreements as to any changes in the plans or specifications should be mentioned in the contract.

Owing to the importance of the specification as a part of the contract, it would be well to consider what the specification is before dealing with the contract and the contractor.

When an architect is employed in preparing the designs, plans and other drawings, it is usual for him to make out the specifications.

The *specification* is the written statement containing minute directions and description of the particulars of the work to be executed and materials to be provided, with reference to the drawings and the special building for which they are prepared, are explanatory of and must be used in conjunction with the drawings. As the architect must determine and describe the character of the work and direct the methods and processes, it is essential that he should possess a thorough knowledge of his art, a practical idea of qualities, quantities and properties of materials, as well as those available in the various localities. The importance of an accurate specification or description of the materials and work to be used and performed in the execution of a building is

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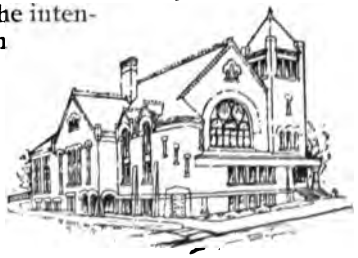
almost as great as the preparation of the drawings for it, neither being complete without the other. The completeness of the building and the freedom from extra charges on settling the accounts, will mainly depend on the clearness, fullness and accuracy of the specification, although it is but justice to the architect to state, that extras arise almost as often from the caprice of the employer as from other causes.

Contracts should invariably be reduced to writing. Great care should be exercised in their preparation, as contingencies must be provided for, and the technicalities of many branches of the builder's trade and numerous stipulations as to quantities and qualities, — time, extras, alterations, etc., duly considered;

besides which there are many important details which must not be overlooked.

The *conditions essential* to a contract for building are as follows: The erection of a building is proposed, the same is definitely indicated in every detail by the various drawings and specifications; these are adopted or approved, various contractors are solicited to estimate on the cost of execution of same in conformity with the drawings and specifications. The various proposals are received and considered, one is selected and accepted. This really constitutes the contract. One party,—the first—proposing to perform certain specific work and provide material therefor for a stipulated consideration. The other party—the second—accepting the proposal and agreeing to pay the first party the price asked. The written contract is but the evidence of this agreement, and a memoranda of conditions, times of payment, etc.

In *soliciting proposals* for the erection of any building, it is presumed that it is the intention of the owners to proceed with the work, and that the proposal of some one of those solicited will be accepted,—presumably the lowest;—and unless the right of rejecting any or all proposals is stipulated, the owner will be liable to the party who submits the lowest proposal, for damages for refusal to enter into contract. This responsibility will not pertain however, in the case of a proposal submitted which has in no way been solicited, or consideration implied by acceptance. A proposal should not be rejected without reason, especially if it should be the lowest. The form of contract which most nearly covers all contingencies, is known as the "Standard form," and is generally accepted and used in practice throughout the United States. This was formulated by Committees from the American Institute of Architects and the National Association of Builders, with legal advice and is considered the best form of building contract in use.



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The law presumes that the party contracting to erect a building according to provisions of a contract, drawings and specifications, *understands them*, and he will not be allowed to escape liability on the ground that he exercised ordinary care and skill to understand the same but failed to comprehend them.

The law also presumes that he is competent to fulfill its stipulations, and further imposes on him the duty of executing his work with diligence and care, and where time is not stated a reasonable time will be inferred, and his duty is, to faithfully carry out the plans placed in his hands, strictly in accordance with the stipulations of the contract, he is responsible for those whom he employs, and is liable for damages for any unnecessary delays. On the other hand, if part of the work is to be performed by the owner or his agents, the law presumes that he will see that his part of the contract is diligently performed, and that he will not impede the contractor in any manner, and if the completion of the work is impeded or prevented by the unwarranted acts of

the owner, the contractor may recover damages; the measure of such damages may be the entire contract price or more.

Every Church organization should be legally incorporated, and in making any contract, care should be taken that they are represented by the proper authority, and that the character of the work proposed is within the province of the corporation or can reasonably be inferred from its charter.

The same caution should be observed in dealing with the contractor that they are properly and legally represented.

Owing to the fact that the Architect is legally the interpreter, and to a certain extent the arbiter of all questions pertaining, he is much the best qualified to determine the conditions of contract and see that the same are complete and just; provided he should possess the requisite practical and technical knowledge.

Various customs are observed as to the method of awarding contracts, either as a whole or sectional. Complete contracts are seldom made, especially for the erection of churches, special and artistic work being generally reserved. All mechanical and skilled manual labor and materials necessary thereto being generally included in one general contract, leaving the artistic, professional and special work to be provided under special contracts. Thus, in making a general contract for the erection and completion of a church, the professional and special work, such as the heating and ventilating, the electric work and sometimes the plumbing and sanitary work, are omitted, as is also the artistic work, such as the Art and Stained Glass, mosaic work, modelling and carving, decorations and all furnishings; with these exceptions, it is advisable to place all other work in the hands of one general contractor, as it is generally conceded that the parties to an entire contract are bound to execute *all* its stipulations, and can recover no part of the consideration until the whole is performed; the parts indicated as omitted, not being essential to completion of the remainder. In the sub-division of contracts among the several trades, there are numerous items and parts difficult to determine where they properly belong, and almost invariably something will be overlooked which the owner must provide, always at an extra expense, not to mention the annoyances, differences and confusion resulting from different forces of employees operating on the building at the same time, all of which would be included in the duties of a general contractor, and thus obviated.

When a party contracts for the erection of a building, he agrees to pay for that which is not in existence at the time of the agreement, and it is but reasonable and just that the work to be performed should be subject to approval, by some one competent to pass on the character and quality of work and materials. Yet it would virtually check a great proportion of builders, if they were obliged to wait until the completion of their entire undertaking before being paid. This objection is met by adopting a method or plan of paying a certain percentage as the work progresses, always taking care that enough will remain due the contractor upon completion to make good any defects which may be discovered prior to final payment.

These partial or accommodation payments are only made *on account of the work done*, or are really *advances* or *loans* made with the *work done as security* and *must not be construed as acceptance*, the *work only being accepted as a whole*. These partial payments may be based on estimates made periodically — gener-

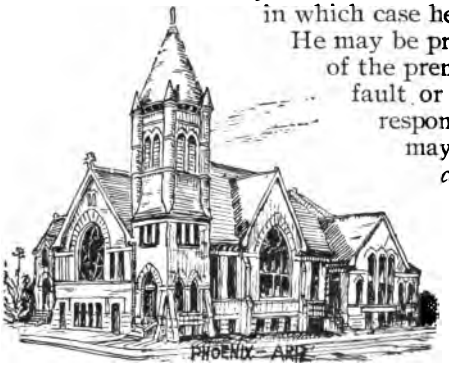
ally monthly,—as to the value of the material delivered or placed in the structural position and the work executed, reserving a certain percentage, usually 10 to 20 per cent. for contingencies; or the payment of certain specified sums at certain stages of the work.

As the Architect is the natural and proper arbiter of all disputes which may arise between the owner and contractor, supposed to be thoroughly competent and conversant with all the details

of the building art, with his reputation dependent upon the perfect execution of his designs; it is therefore advisable, that a provision making his certificate or that of a competent superintendent necessary as a condition precedent to the payment of any money, and should be included in the contract. Under these conditions no certificate except the *final* one can be considered or construed as an *award* or *acceptance*, and compensation cannot be claimed or collected for work which has been

performed and which is not satisfactory. The *final certificate* must be procured as evidence, and unless fraud can be proven is final and conclusive to both parties. Architects generally exercise *general supervision* over their works when conveniently located, consisting of advice, directions, instructions, etc., as well as personal visits of inspection during progress, of such frequency and extent as may be necessary to determine if the work is being executed in conformity with the true intent of the designs and specifications.

Continuous personal superintendence is secured when necessary, by the employ of a superintendent of construction or clerk of the works, subordinate to the supervising architect but employed by the owner. The contractor may fail from several reasons to complete the contract: 1st — He may be prevented by the other contracting party or his agents, in which case he is *not* responsible. 2nd — He may be prevented by the destruction of the premises, whether from his own fault or unavoidable accident he *is* responsible. 3rd — Performance may be *impossible*, — only *under certain conditions is this an excuse;* such contingencies should have been provided against by contract. Even the possible non-existence of material should have been foreseen. 4th — The act of God, — unless this renders performance *absolutely* impossible it is not a defense. 5th — A contractor cannot recover for work executed which is in violation of the laws, therefore not complete.



Although the Contract may be silent, the law implies that all work must be done in a workmanlike manner, even if the price is inadequate, or should the owner see the work done without protest. In drawing a building contract, it is advisable not only to bind the builder to complete his work within a certain time, but also to provide against all contingencies which may arise, making due allowance for extras which may be ordered, strikes, bad weather and other causes not under the builder's control.

By the strict letter of the common law, failure to complete a contract by the time agreed would virtually allow the other

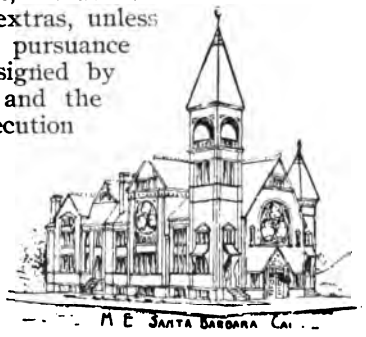
Party to rescind the contract; in equity time is not considered a condition entering the essence of the contract to such an extent as to invalidate the contract, the measure of violation being the damages sustained; stipulations may however be so worded in the contract, that nothing whatever shall be paid unless completed within the specified time. It then becomes an *essential condition and can be enforced.* A contractor may bind himself arbitrarily to complete work within an unreasonable time, and the express conditions of the contract be sustained; ordinarily a forfeit for non-compliance is a condition of contract, the same may be a penalty or as liquidated damages. A penalty cannot be exacted if excessive, actual damages only can be recovered; liquidated damages, is an amount agreed upon previously. Work however that is accepted and valuable to the owner may generally be recovered for, less actual damages, although not performed within the time limit.

Extras and alterations, as well as the failure of other parties to perform work or supply materials essential to the progress of contract work, whether by owner or other contractors, and unavoidable accidents have the effect of extending time, unless the contractor should be bound by contract to make any alterations which may be ordered, no matter of what character, expressly stipulating that the entire work including extras or alterations—shall be included in the time condition. If any one in direct terms, enters into a contract to perform an impossibility subject to a penalty, they will not be excused because it is an impossibility.

The standard of damages, in case the owner sustains losses by failure of the builder to complete work at the time specified, is a fair rental of the property for the time delayed, or actual damages sustained by this delay; speculative profits unless clearly incidental cannot be considered. On the other hand, if the contractor is prevented from completing by interference and default of the owner, he may recover reasonable worth of work and materials and profit, and not pro rata. A contract "to be performed directly" means speedily—as quickly as practicable,—while a contract "to be performed forthwith" does not necessarily mean immediately. If a contractor is prevented from entering into or commencing work as agreed, after the contract is signed or the agreement made, he may recover damages, generally measured by actual losses and reasonable profits on the contract.

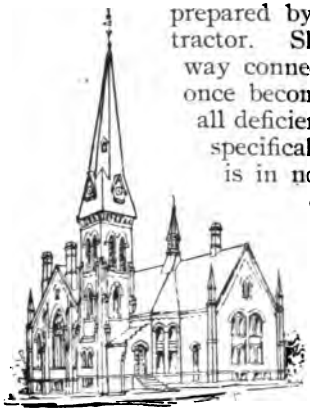
Those with experience know, that by some mysterious process of calculation things valued *afterward*, always cost more than if contracted for *beforehand:* likewise, the value of work *added* is

always greater than for the *same* work *omitted.* A bill of extras is a bill of horrors to any owner or conscientious architect and is to be avoided, complete plans and specifications should do this. It is well to stipulate in contract, "that no allowance will be made for any extras, unless the same shall have been done in pursuance of a written contract or order signed by the architect or superintendent, and the price agreed upon previous to execution and endorsed on said order."



It is an established and well settled fact, that an owner can recover damages for *inferior* work or materials, but that the contractor cannot recover for *better* materials or work than specified, without the direction or consent of those in authority; supplying such work and materials being voluntary and not obligatory.

It is sometimes found advisable to secure bills of quantities of materials to be furnished and schedule of work to be executed. This may be supplied by the architect or a quantity surveyor, according to custom. It is not best however to recognize in any way a schedule bill of materials or labor, either prepared by the architect, surveyor or the contractor. Should such schedule become in any way connected with the contract, the owner at once becomes responsible for its sufficiency and all deficiencies will appear as extras, unless it is specifically stipulated, "That the second party is in no way responsible for the correctness or accuracy of schedules."



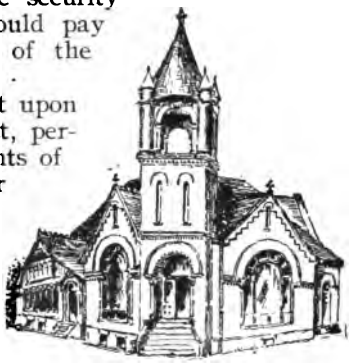
Building contracts are seldom entered into for construction of public or corporate buildings, without security for the faithful performance of the work. The general rules of law relating to suretyship govern the legal status in this as in other contracts. Thus, where a surety guarantees that a builder will execute his contract to the satisfaction of his employer, and the contract is materially altered without his assent, he will be discharged from responsibility

whether the change is prejudicial to him or not. Also if the time limit is increased without assent.

The obligations may also be discharged by the acts of the owner, by the payment of moneys before due, or failure to insure if so agreed, also making advances other or larger than agreed, or a change of the terms of contract in any way or manner without the consent of the surety.

When there is a penalty named in contract, the liability of surety cannot go beyond it but may be less.

In case of the failure of contractor for any reason to perform his agreements, the surety is expected to assume and complete same, or at least to assume responsibility, in which case the owner should do nothing to invalidate the surety. In case of failure of the contractor, and the security guaranteeing bills, the owner should pay nothing except on the certificate of the architect endorsed by the surety.



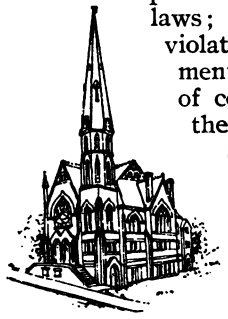
It is a general rule of law, that upon the death of any party to a contract, personal estate or personalty and rights of action pass to an administrator or executor, and *realty* to heirs; consequently, all contracts which are not personal, pass to his legal representative or successors, but where the contract relates to *personal* service or skill, death dissolves the contract. Building contracts are seldom of this personal character, while those of a professional and artistic character are, being dependent on the personal skill of the party, while under certain conditions they may pass this stage—such as the work of the architect, decorative artist or sculptor, when the skilled, personal work has been performed, designs made and only the execution of same remains, and which can be executed without injustice to those who exercised diligence in the original design or selection.

The right of property in materials furnished—being personal,—passes to the purchaser upon delivery, but questions may arise as to whether the owner or the builder is the purchaser. It seems settled that the ownership passes to him upon whose credit it has been furnished. Building contracts frequently contain clauses determining the right of property. Mechanics, contractors and others have a lien which they can enforce

irrespective of the ownership of the building. The lien laws of the various states differ and are frequently changed, hence these questions can only be determined by time and location. It is generally held that the property passes to the owner as the work advances and becomes a permanent fixed part of the building and of the realty, when it cannot be subject to execution. Any unpaid portion of the contract price may be attached in owner's hands, but not to the loss or disadvantage of the owner.

Where a building contract makes no reference to old structures to be removed, standing upon the land, the materials become the property of the builder, and the owner is not entitled to allowance therefor.

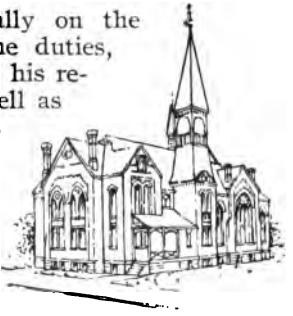
Nearly every locality has its own ordinances or laws, regarding the use of highways and streets for or during building operations. Also certain general or special building laws; non-compliance constitutes a nuisance or a violation. The owner may be responsible for abatement, damages or neglect according to the nature of contract. Where the builder contracts to do the entire work, employing his own mechanics, and assuming entire charge over the construction of the building, the owner cannot be held liable for injuries caused by the builder during the progress of the work.



To render the owner liable for damages incurred by the builder, the relation of principal and agent or master and servant must be established. A safe rule is that where the employer has no duties, he is not responsible for damages arising from the contract work,—but, if the execution of the contract work itself would necessarily injure others, or become a nuisance, he will be jointly responsible as the act is his; if he orders precautions taken, he must see that they are actually taken. As there is always a certain amount of responsibility which cannot be avoided, it is essential that honest, competent contractors should be selected, and not allow price to alone determine. An owner cannot avoid responsibility, who knowingly accepts a careless, incompetent, or dishonest contractor, and the fact that he employs an architect or superintendent to oversee the work will not relieve him. No amount of supervision will make an incompetent man competent, or a dishonest man honest.

The construction of buildings is guarded and regulated by local statutes or ordinances, regulating the height and thickness

of walls, height of buildings, character of flues, party walls, materials, protection and innumerable other matters touching precautions to be observed for the safety of passersby, such as danger-signals, lights, etc., besides sanitary regulations as to plumbing, drainage and sewerage, also the introduction of electric wires and appliances and heating apparatus as regards the safety of the building. Certain permits must be obtained, inspections made and various other conditions complied with before building operations are commenced. It is essential that the architect should prepare all his work in accord with these various regulations in order that permits may be granted, and that the various drawings and specifications may comply without modification or change after the permits are granted; the general duty of seeing that regulations are complied with devolves upon the builder rather than the owner.



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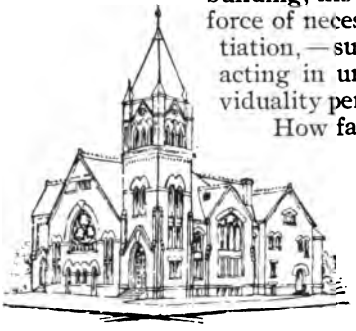
Having thus far treated principally on the relations of the general contractor, the duties, responsibilities and liabilities of same in his relation to the owner or principal, as well as relations and duties of the owner, it is well to add a few words as regards other conditions. In the erection and construction of any building, large or small, the work of many trades is involved, and the various materials essential; also professional services of specialists in various departments; likewise in the artistic and esthetic treatment the personal attention of some one skilled in that special work or department is desired. All of this various service can be secured by special contracts for each, or by days' work, the owner supplying the material. If the special contract is of considerable magnitude, the same conditions heretofore referred to may prevail if the relations are agreed upon and pertain, in which event the owner should see that as far as possible contractors are made responsible to each other and their proper relations indicated and understood, otherwise the owner becomes the go-between or medium through whom each contractor will endeavor to advise others of their duties and requirements, and often unconsciously assumes responsibilities not legally belonging to him.

In the division of contracts, where no one is responsible in a general way for the whole, this duty or obligation pertains to the

owner and the relation and responsibility is more that of employer and agent or master and servant. As churches are almost invariably erected for a congregation or society, and by Trustees or appointed Committees as agents, previous determination of all expenses, and the placing of all responsibilities possible with the contracts, seems the wiser course. The authority for contracting indefinite liabilities, or assuming unnecessary responsibilities which may even involve property or title, may be questioned, in any event it seems bad policy.

Originally the architect was the master builder, performing all the functions of design and construction. In the course of development and evolution, and the vast advances in the art of building, his work or duties have from the sheer force of necessity come under the law of differentiation,—subdivision into a number of parts acting in unison,—in place of the single individuality performing all the necessary activities. How far this process has been carried for us to recognize to-day, and the limit is not yet reached. Thus, the architect is really the selector and assembler of parts,—an artistic assembler, who groups into an orderly arrangement, a multitude of details, according to a foreordained esthetic design; and building operations of to-day are successful in proportion to this subdivision of labor among those especially trained, skilled or fitted for their several specialties.



Swedish Lutheran · Galesburg Ill.

The general contractor is likewise an assembler, but his interests are financial and mechanical, selecting and securing in the markets those parts of labor and material which go to make up the contemplated structure in accordance with the standards prescribed by the architect. Thus, the critical stage of every building enterprise, is the successful and satisfactory placing of the various contracts, in such manner as to secure the desired results, determine duties and responsibilities, and avoid possible litigation.

Owing to the fact that the construction of a church differs materially from almost any other character of building, one should build several to secure the experience necessary to build economically and well, all of which will result to the advantage of both the church and the builder. Therefore when possible the services of an experienced contractor should be secured.

CHAPTER VII.

ADVISORY.

HONESTY vs. SHAMS.—AN APPEAL.—DUTY.

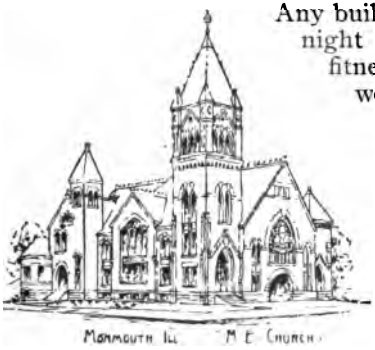
O MAKE false use of materials, to introduce frauds and cheap imitations, to temporize for the sake of saving to-day what will cost double to-morrow, to construct churches or any buildings, that as long as they endure, will proclaim to friends and foes, to citizens and strangers, the vanity, parsimony, or ignorance of the people who build them,—all these conditions should be understood and avoided. In some instances poverty may be urged as an excuse, but the most grievous faults are not those of poverty, and not even economy; poverty is oftentimes an advantage and beneficent in its effect on architecture as on character, in preventing the growth and display of coarse and disastrous inclinations. There was a time when ignorance was excusable, but neither poverty nor ignorance can now be accepted in extenuation for badly designed, badly planned or badly constructed churches.

No building can claim architectural excellence which is not perfectly adapted to its site, its use, the character and dignity of the people who build it, the length of time it is expected to exist, and to the influence it ought to exert upon the community in which it stands. Obviously a building designed for a hill will not be suitable for a level, neither will one designed for a village be appropriate for a crowded street in a city. It would be inexcusable to build a church that might be taken for a prison, a school or a factory. What would be appropriate for a wealthy congregation in a large city would be sadly out of place representing the moderate means of the country parish. Suitability to the length of time a building is expected to exist involves the question of materials and those of construction rather than the visible surfaces.

At the present time there are but three classes of material suitable for the erection of any building intended to endure a century or more; clay, stone and metal.

Clay including all kinds of brick, tile, terra-cotta, concretes and cements. Stone — only including such natural building stones as are not seriously damaged by fire or disintegrate when exposed; and under Metal, — including steel, iron and all metal work. Under proper conditions these are practically indestructible by time or fire, *and none need be ignorant that the difference in cost between a building that cannot be burned and one that will melt away in flames like frost before the sun, is so slight that it would not be extravagance to so construct all the better class of churches and in the end prove real economy.*

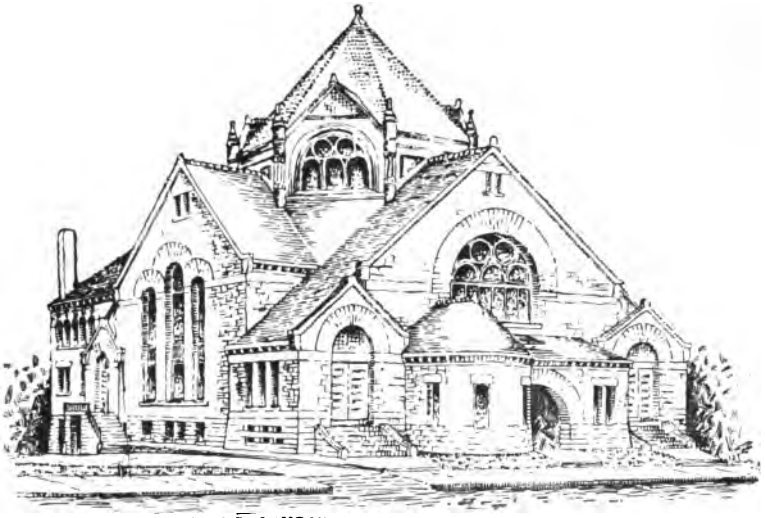
To fireproof the dangerous places, or to adopt so called slow burning construction, serve the purpose well as far as they go, but really only drive the danger elsewhere, and the false security results in the hottest fire when it does burn.



Any building that can be destroyed in a night does not possess the quality of fitness for long life. In no class of work is honesty so essential. The object lesson of unbusinesslike methods, or deception in the use of materials in construction, may neutralize much of the work of the church. Superficial honesty is not radical truthfulness. A man's words may truthfully express his thoughts while the thoughts themselves may be utterly false. In considering the influence a church may exert on the community in which it stands, we enter upon sentimental and esthetic grounds. There

is also a practical side. Improved methods of building as regards construction, utility and economy are desirable, and the erection of a church building in any community should be an object lesson to the community, illustrating the best methods of building. The erection of a house of worship by any congregation is a legitimate work, "by their works ye shall know them;" how often are their business methods and character of buildings insinuatingly compared with secular work from which much less is expected.

Churches as exemplars of morals should practice what they preach, and not erect amazingly impressive lessons of



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"what not to do," silent teachers of things to be avoided in the matter of materials, workmanship, and business methods. There must be a cause for this; it is not in the teaching, precepts or morals of the church, why is it in the practice? Simply because what is everyones business becomes no ones business. Men perfectly competent in the management of their own affairs seem to lose their common sense in attending to those of the church; in many instances the common cause lies in the popular notion that *home talent and business* must be patronized and encouraged. If the results passed away with the passing of the possessor, like the work of the merchant, the

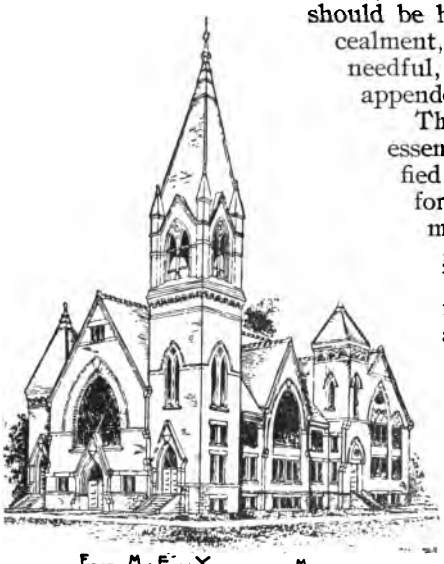
banker, the tailor or the butcher, there would be no danger in indulging in this sentiment.

The result remains however as a permanent bane or blessing to an unlimited posterity. The determination of these questions becomes a grave responsibility, demanding some stronger reason than the accident of residence or location which at most is but temporary. There is a duty which every church owes to the community in which it is located, which is a sacred duty and a part of its legitimate work,—as it wields a silent yet powerful influence—which should be for honesty and integrity in practice as well as principle, and should not be subservient to selfish interests or local sentiment.

If ever the world experienced a plague disguised as a popular fad or fancy, it is wrestling with one now in the shape of imitations in building materials which have become epidemic. Imitations of stone are produced by exterior plastering on wood or brick, coloring and sanding, blocking off with pencilled lines to represent mortar joints, cheap stucco mouldings and carvings. A brick or stone wall can now be delivered in sections and nailed in position by the sheet metal contractor, representing any character of brick or stone work, which in the hands of the painter becomes oölitic limestone, Superior or Longmeadow brown stone, Seneca Red Stone, marble or brick of any desired color as the exigencies of the occasion demand. Moulded, carved or modeled surfaces are also imitated with marvellous skill.

Not only are materials imitated, but forms as well: what consistency is there in wooden buttresses nailed to the outside of a wooden frame, or an imitation stone spire perched on the ridge of a frame church, or brick pinnacles perched above warped useless buttresses, crowned with a sheet iron head-dress of strange device. All these imitations or false uses of material are barefaced deceits, and were they not so co—

mon — undeserving of mention. False sentiments uttered in the Pulpit may be forgotten as soon as expressed, but an effort to deceive God and man in building a lasting memorial remains as a monument of folly. There is no sacredness in any architectural form, that would require a wooden church to be designed in the lines or in imitation of a stone Gothic church. The righteous use of material of any character, in the simplest undisguised form appropriate for the purpose, is to be commended; each has its uses. Nothing should be hidden for the sake of concealment, nothing omitted that is needful, and nothing introduced or appended for mere outward show. The frank appearance of every essential detail should be justified by its own perfection of form and color; truth is the most direct route to every good thing, strength, beauty, economy and permanence. There are certain and immutable natural laws which indicate appropriate uses of material. The strength of stone or brick lies in its resistance to crushing; wood bears a crushing weight, a tensile strain and resists in a limited degree a bending force. Cast iron is stone condensed in volume, and wrought iron or steel rods and bars are bands not easily torn asunder. These materials if disposed with just regard to these laws may be made to express great beauty as well as their purpose and part in the structure, thus at the same time imparting a sense of security. Perfect mechanical construction should be united with the finest art. All material is appropriate if consistently and honestly used, in proper forms, and for appropriate purposes. Artistic treatment should consist of proper color effect and *the ornamentation of construction, not the construction of ornament*, and such shams as stained glass windows made of paper, printed mosaics and mural effects should be studiously avoided.



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CHAPTER VIII.

SPECIFIC.

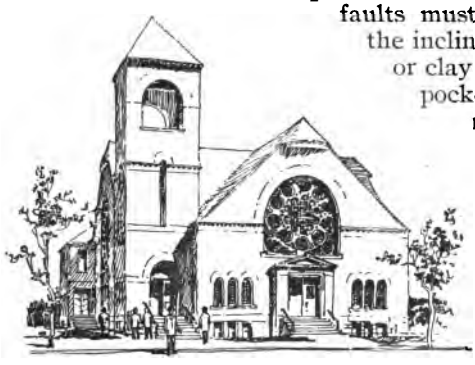
THE SITE,—FOUNDATION, WALLS, ROOF CONSTRUCTION, CEILINGS, FLOORS, SECURITY AND SAFETY.

ONCERNING the site for any public building and especially a church, a fatal because incurable mistake is often made in their location, and more frequently in the small amount of land secured. Leaving esthetic and sentimental consideration aside, it is simply common sense to say, that for all practical purposes the lot on which each one stands should be large enough to allow adequate natural lighting of the interior, and to afford ample and direct entrances and exits, and to preclude all annoyance from the ordinary use of the nearest streets. In large cities where land is exceedingly valuable, the character of the ground is of comparatively small importance, while in other localities it may prove a prime factor. It would be difficult to find a piece of ground on which by the aid of engineering skill the heaviest kind of structure may not be placed in absolute security and permanence. The point of fitness to site is double faced, before the building can fit the site the site must be appropriate to the building. The site, and especially the environment has much to do with the character of the design.

Prior to determining the style or character of design, the designer should have some idea of the surroundings, as the contemplated building is to become a permanent part of the group or mass if contiguous to other buildings, or if isolated, a part of the landscape, hence the necessity of securing either the proper harmony in effect, or possibly a desirable contrast both as to color or design. In forming our conception of the immediate surroundings of the house, there are two extremes, on the one hand there is the polished beauty of the artificial environment, and on the other the picturesque beauty of untouched nature. For isolated build-

ings and esthetic effects, the designer should possess qualifications as a landscape architect and design the grounds as well — the same artist that paints the figures and objects should paint the landscape — we could readily understand the mistake of such a combination of talent by the employ of two artists in a purely artistic production, and the lack of harmony which such a composite medley would produce. One mind must conceive and one hand must design all parts of a picture of any character real or artificial.

Practical considerations in the selection of site are of as much importance as esthetic. Is the soil rocky, clayey or sandy? the last much the more easily managed, the two former requiring more or less care and usually giving more or less trouble. The possible existence of many concealed faults must be ascertained, such as the inclined stratification of rocks or clay beds, lack of uniformity, pockets of quicksand, subterranean water courses, old ravines or water ways which have become filled, buried bogs, etc., etc. Consequently for the larger buildings tests of the earth must be made, also careful calculations regarding the weight of every portion of the proposed building and the value of the earth to sustain weight estimated. In order to secure equal settlement, all foundations should be properly proportioned so as to distribute approximately the same weight per square foot over the entire foundation. Many loads are transferred by the character of the work and are not borne by the foundations directly below them, all of which must be considered. Sand and gravel of the proper consistency or character make the best foundations when properly protected. The one great trouble with clay or rock foundations is from water that drains into any excavation we may make and stays there. There are sand veins and fissures in all clay beds, and crevices in nearly all natural rock through which the water will percolate and settle around the foundations.



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When thus saturated, if the building should be located over inclined strata of either rock or clay, there will be a sliding motion of the whole or a part, and the greater the weight the greater the movement. The building may be located over or near a bed of quicksand, sufficient — if confined and dry, but may be released by some future contiguous excavation, or may become wet and bulge up in cellar bottom where the confining earth has been removed. In many localities old water courses have been filled and their existence forgotten. The location of any building on the inclined banks of same is very nearly as bad as to build the foundations on a hillside without first leveling. The same precaution must be taken, and if any subterranean water courses are found, provision must be made for the free passage of the water, as the obstruction and damming up of water, whether surface or subterranean, is certain to result in disaster; experience and good judgment are essential in determining the hidden mysteries of the foundation which are vital to the stability of any building, and such precautions must be taken as will be the result of experience, hence those in charge should be ready for any emergency, and possessed of many resources for positively and economically counteracting all existing faults. Excavations should always be of sufficient size to allow working room on the outside of walls, so that same can be properly constructed, pointed and plastered. If the natural drainage should be toward the building from any side, precautions against

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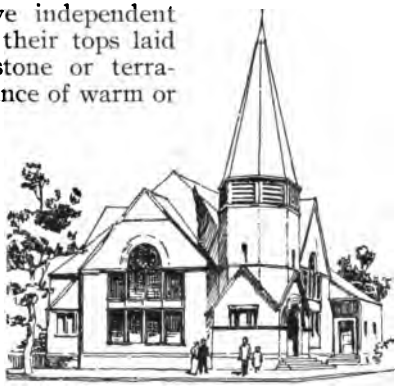
the percolation of water through walls must be taken. All foundation walls should be laid in cement mortar and plastered on the outside with the same. Even if there is no water in the soil the rain which dashes against the superstructure walls should be prevented from following down and penetrating the foundations. Where possible, blind drains should be constructed on the exterior, but must have some outlet or they are detrimental. If the building is so located that connection may be had with sewers lower than the foundations, the task is comparatively easy. The confined space inside of walls must also be connected. Where the excavation is lower than the sewer or possible outlets, all water must be gathered into a sump and withdrawn by the use of an automatic cellar drainer. The application of an exterior coating of asphaltum

such as is used for roofing paint is of advantage in extreme cases in securing dry basements. Foundation walls of stone or brick should be of proper thickness and wherever possible located central under those they support, started from stone or concrete footing courses of increased width. In damp climates or localities, *damp courses* should be built in wall above grade to prevent the moisture rising by capillary attraction, thus making the walls of superstructure damp.

The use of cement in all mortar for laying masonry walls should be insisted on; that below the surface should be stronger and of a hydraulic nature, certain proportions of lime and cement

being mixed with sand for those of superstructure, as pure cement mortar is liable to set too rapidly for its advantageous use. The great advantage of cement mortars for all masonry in securing increased strength and durability is more than a compensation or justification for the slight increase in expense. Soft brick or inferior stone should never be used in any wall, and especially where exposed to the weather or contiguous to any flues. The disintegration of any of the material in a wall means the weakening of the wall; the gases and acids passing through smoke flues have a very serious effect on mortars or material. Soft brick will crumble to dust, and mortar rapidly disintegrate, which is a source of danger. Every flue through which smoke is passed should be lined with fire-clay flue-linings built in as the walls are erected.

All chimneys should have independent smoke-flues for each fire, have their tops laid in cement and capped with stone or terra-cotta; all flues for the conveyance of warm or hot air should be lined with sheet metal, or if very large built of brick smoothly pointed or cemented. Plastering flues for any purpose is bad practice, as the plaster almost invariably falls off in time, and obstructs the flue, leaving the walls rough, the brick laid smooth with all joints smoothly pointed full and flush, makes the best flue.



There are innumerable minor details essential to good work, which are often overlooked by those lacking in experience, only discovered in after years by their absence. Thoroughness in all the smaller details and matters are essential to economy; the building which is only superficially complete is a constant source of expense in the way of charges and extras, the vital importance of perfect and sufficient foundations to any building cannot be over estimated.

In constructing the walls, precautions should be taken to prevent dampness penetrating or passing through same. As a preventive, walls are built hollow, or lined with hollow brick or are furred on their inner surfaces, then lathed and plastered, or

treated on a vertical joint with a *moisture proof preparation.* A hollow wall is much weaker than a solid one. The hollow space, rarely more than one or two inches becomes partially filled with mortar and debris, thus only partially accomplishing its purpose. The bonding of the walls across this space, necessarily breaks the continuity of the space and results in spotted walls, only dry where the space exists. *Bond irons* should be used both for hollow walls and for anchoring any facing of stone or brick to the exterior thus breaking continuity of material which is essential in securing best results.

Furring the walls creates spaces which, unless carefully stopped at each story, become flues for the rapid spread of fires and vermin; hollow brick serves every purpose, does not increase the thickness of wall and costs less than wood furring and lath. A preparation recently introduced for coating the inner surface of walls similar to a paint, effectually prevents the passage of dampness, leaves the walls solid and avoids all spaces, thus saving much valuable room. The building will be more susceptible to changes of weather on account of the lack of air spaces in wall however.

Plastering covers five of the six sides of almost every room or apartment, and is a very essential part and finish of the interior.

Before the period of plastering begins, all iron plumbing pipes not intended to be exposed, all gas pipes, conduits for electric wiring, speaking tubes, tubes for mechanical, pneumatic or electric bells, etc., must be in place, and all wooden partitions or furred walls and ceilings lathed. As much depends on the character of preparation for the reception of plastering, the best lath, properly placed are an essential. The use of metal lath properly placed and secured with all joinings properly made is of great advantage and well worth the difference in expense, besides the great advantage of forming it to any irregular surface, following the contour of beams and mouldings, thus saving much material and weight and the otherwise serious fault of various thickness of parts and members, thus occasioning irregular drying. In selecting the character of metal lath there are many kinds in the market, and but few really to be commended for *all* purposes; combined with the proper plastering mortar they form thin walls of masonry, as enduring and stable as the construction, and practically fire-proof in themselves.

Partitions may be made of this metal lath plastered on both sides, without the use of any wood work in connection, perfectly rigid and very thin.

There is no material for plastering better than good lime and sand mortar *properly* made, but strange to say, the matter of plastering has not kept pace with other improvements, it has *deteriorated*, and the plaster of to-day generally is *not* as good as it was years ago. The sand should be moderately coarse, sharp and clean, for all first-class plastering the sand must be washed and screened both to take out the fine as well as the coarse particles, the lime well burned and *thoroughly slacked 30 to 90 days before using;* the longer the period the better the results, provided it is covered to retain the water and retard setting; using good fibre instead of hair,—hair being an organic substance is destroyed by the action of the lime, destroying the texture of the plaster, while fibre being a vegetable substance is preserved by the lime and will endure as long as the mortar. Thorough mixing is an essential factor which can only be secured by using machine mixed mortars.

Time is an element however in the preparation and application of all lime mortars for plastering, which often cannot be taken even to secure best results. This delay can be avoided by using some of the recently brought out prepared cementitious plasters. These plasters require skillful handling, setting with great rapidity, so that contrary to the practice with lime and sand, it must be mixed as used, and *should never be adulterated.* Prejudice against new ideas is often a cause of disastrous or unsatisfactory results and its improper handling, either through intent or ignorance. Great caution must be taken in adopting any of the new, hard or patent plasters, as there is much that is bad, some showing the best immediate results, disintegration commencing very shortly; others containing chemicals destroying all decorations, etc., while others contain acids which totally destroy all metal work with which it comes in contact. Very seldom can any of the patent plasters be used in connection with other mortar without disastrous results. Very good results may be obtained by mixing cements with ordinary mortar, giving a harder and quicker setting plaster. They should only be mixed as used however and add but little if anything to the expense, no mortar should ever be used that has once set. For the

reception of Mural decorations, no better preparation can be made than what is known as sand finish, smoothly cork or felt floated, the more elaborate finish in mouldings or modeling being executed in stucco, cement or gaged mortar.

In excavating for foundations, some unexpected fault may be met such as a quicksand, the bed of some old water course, a mixture of clay and sand in pockets or strata, etc., etc. The supervising architect should be able to at once determine what will be the safest as well as the most economical method of securing against all possibility of danger or damage, either by piling, concrete, stone, or a combination of steel and concrete foundations. If the location is over an old water course, the water must not be impeded or obstructed.

The owner, the various contractors, mechanics, and the building superintendent all want someone to go to in an emergency for instructions and advice, while the architect, who may not have anticipated the trouble until suddenly called upon to provide a remedy or way to overcome the difficulty, must depend entirely upon his own judgment and experience and must be able to quickly determine what to do and how to do it. He must therefore be a man of ability and resources, as well as a man of experience and always ready for an emergency. The Architect has no one to go to in an emergency for counsel or advice, but must assume the position, properly his, as the head of the building business. The great risk and fallacy of employing an inexperienced, incapable man should be apparent and guarded against.

Unless fire-proof construction is adopted, there will be much timber used in the construction, therefore due consideration of the characteristics of the various woods obtainable will be proper in this connection.

The timber most frequently used is white pine, spruce and hemlock, with yellow or Southern pine in the south and east,—cottonwood in the west, Redwood and fir on the Pacific Coast, and a species of pine called Norway in the north. Of these, unless great strength is required, redwood is probably the best, being strong, straight-grained, less subject to shrinkage than any other, and obtainable in almost any dimensions. White Pine is similar, consequently next in value, while for strength Norway is superior to it, otherwise for constructional work may be considered practically the same. Cottonwood is soft, shrinks very much: Spruce resembles Pine but shrinks more and is apt to warp, twist and check or crack open near the middle of the stick:

Fir is very similar to Pine; Hemlock is a harder wood than Pine or Spruce and can be had in large sizes, but its strength is impaired by the lack of cohesion between the annular rings which allows the timber to crack seriously while drying. Hard, yellow or Southern pine is much used where its great stiffness is of advantage for beams, ties, trusses, etc.; it also shrinks considerably in drying. As all timber is cut to the schedule dimensions, it is only of full size while green, thus, a piece twelve inches in width of white pine will shrink nearly half an inch, spruce, hemlock and yellow pine will shrink two-thirds of an inch, and cotton-wood will shrink an inch, while redwood shows no material shrinkage except in length, in which it differs from most other woods. No timber should be used which indicates the presence of dry rot which is a fungus growth or disease, and is infectious. The introduction of one infected piece may spread to all timbers and destroy the building.

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All timber should be properly used, framed or united; for posts, or parts requiring extra strength hard woods such as oak are frequently used, and for long spans compound girders or

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trusses are built up to secure the required strength. Iron caps, bearing plates, etc., should be used to equalize and distribute strains of timbers to prevent crushing of fibres or fraying.

For basement floors the best method is to imbed the beams in concrete which will preserve the timbers and prove an effectual barrier against dampness and vermin. A double floor is always of advantage, the first or rough floor protecting the building during erection, affording platforms over which the men can move freely, and serving until the building is ready for final finish which will secure perfect floors on completion. As church floors are carpeted, the finished floor should be of narrow strips of pine or spruce matched and well nailed. All beams should be thoroughly secured and bridged and all furring and studs forming partitions or walls properly secured in position, with all spaces effectually closed off at each story or floor to prevent the spread of fire or vermin. Partitions over spaces without any direct support, should be thoroughly trussed, and every precaution taken against settlement or drawing apart of angles; dead arches or iron lintels should be used over openings, and all timbers entering walls should be properly anchored, and so cut that in case of fire they can fall out without breaking the walls. Great care should be taken in passing flues; no timber should occur within 8 inches of any, and the flue should be plastered on its outside when contiguous to timbers. All frames should be well anchored, stayed and secured in position unless placed after erection of walls in which case they must be properly fitted and secured. The proper construction of a bowled floor so as to secure a perfect and regular incline is a work requiring considerable skill. Joist should radiate and be properly supported on segmental beams, and the floor laid continuous and not in sections; the proper incline is important as more or less will prove unpleasant and objectionable. An incline of one inch to the foot or over should be built in terraces.

The roof should be what is known as self supporting, that is without any intermediate supports, which are unnecessary and objectionable. There can scarcely be any form of building which cannot be covered in this way. The trusses should be so designed that no thrusts exist, having all strains converted into vertical ones at the supporting walls. For extraordinary tension-strains steel members should be used and all long compression members stayed laterally against buckling; solid timbers of spruce or yellow pine should be used for the stronger trusses, and where the dimensions do not exceed the dimensions possible to obtain. For members longer than the market affords, laminated or built up members must be used. Great care should be taken in this that timbers are perfect, joints tight, well broken,

and all thoroughly bolted. A greater cross section of laminated beam will be required than will be necessary should solid timbers be used. With combination trusses all bearings as far as possible should be right angles, and for sustaining the heaviest loads the use of cast iron connections are advisable; all tie rods should be steel, upset ends and all washers and fittings should be entire width of timbers and of proper angles. Extra strap irons should be used where necessary, and wrought bridle irons to support all purlins or counter trusses unless possible to rest directly on timbers.

For all heavy construction and framing, there are in the market iron hangers, connections and fittings, giving much

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better results as regards strength than the old method of framing which often consists of cutting timbers to their serious damage; in some cases the cost of the iron fittings is less than the cost of framing. In framing about all openings and where passing windows or doors iron hangers should be used. The ceiling of a church is a part deserving careful study as regards form, determined largely by the rules or principles essential to good acoustics, and whether covered with wood, steel or plaster will be determined by the acoustical results desired; either covering will be found very satisfactory if applied under proper conditions.

There are also objections which must be considered and will be treated when considering "Acoustics."

The gallery must be strong and secure with as few supports as possible. In some instances it is possible to support a gallery by means of brackets from the side walls, but in the majority of cases columns will be necessary which must be small as possible to secure strength and not prove an obstruction to sight.

Stairs should be easy of ascent or descent, as direct as possible, and winders avoided, of ample width and properly provided with hand rails. A stairway should connect with the attic, with plank runways over ceilings. Large ceiling ventilators should be provided for the auditoriums supplied with cords extending to vestibule, so they may be operated when desired to allow the heated air to pass off from ceilings of the various apartments into attic; from thence should find easy egress by means provided in attic and on roof.

All marble and tile work should be placed after plastering is completed and careful and proper provision made for its reception. Provision must be made in all cases where shrinkage of timbers may occur, that the same does not result disastrously in breaking angles or other connections.

Roofs are covered with shingles, slate, tile, tin, copper, galvanized iron or various kinds of composition. To secure a good roof,—one of the essentials of any building,—nothing but the best materials should be used: shaved shingles are better than sawed ones, cypress, cedar, fir, redwood and pine are durable in the order given; for a durable roof, the exposed parts of the shingles should be dipped in paint, with a finishing coat applied after laying. It seems folly to paint all the exposed exterior portion of a building for protection, and allow the vital part,—the roof—no protection of this character. The painting of a roof is more essential than the walls. It is of great advantage to lay all shingles on roofing felt. To secure the best results, and the stronger roof, the same should in all cases be covered first with matched sheathing, joints broken and well nailed. Good first quality slate where pitch is sufficient is conceded the best material for roof covering: all slate should be secured with galvanized iron nails and laid on heavy felt. There are many inferior grades of slate, and faults in the better grades, all of which should be avoided. The *best* grade of slate, properly applied, will secure practically an everlasting roof, and may be obtained in various colors to secure different effects, most of which are very durable in the better grades.

Tile is made in various forms and colors and laid similar to slate; mitres and joinings of slate, and especially tile, should be made and secured with mastic cement. Some forms of tile should be entirely laid in cement. The greatest care must be taken in flashing and counter-flashing against all walls, copings or chimneys for any slate or tile roof. This should be formed of the best quality of tin, copper or lead. Unless sheet metal ridges are placed on hips or angles, the same should be protected by concealed flashings and mitres thoroughly cemented,

Tin for roofing is applied in various ways according to conditions; only the best quality should be used: there are so many inferior grades of tin in the market that great precaution should be taken that the *best is provided and used*, even when specified. Only tin which is properly coated by the *old method*, and of a well known guaranteed brand *should be considered.* Any tin prepared by the acid process, will in a short time develop rust in spots which will soon penetrate the sheets, when a roof will become as a sieve and repairs almost impossible. Paint is a great protection but will not make a good roof of poor tin. Copper and lead make very good roof coverings, but owing to the great expansion and contraction of the metal, caused by changes in temperature, should only be used as directed by an experienced superintendent, in such way as to counteract these effects. Galvanized iron and composition are cheaper roof coverings and should only be used as such. Security and durability are the essentials desired in any roof, and should be secured even at the expense of some other less vital part. Equal care should be taken with the gutters, that they are ample in capacity, have proper fall, having a sufficient number of conductors of proper size, should be made of the best material, securely stayed, and all vertical or closed conductors made expandable to avoid rupture by freezing. If tightly connected with sewers to prevent access of cold air to their lower portion the danger will be greatly lessened by the passage of the warmer air of sewers. Water conductors unless amply protected, should never be built in walls or passed through the interior of the building.

Second Christian Church-Q

Questions pertaining to the introduction and installation of the electric, sanitary, ventilating and warming systems, work and apparatus, as regards security to the building, as well as the

health of the occupants, will be more particularly treated elsewhere, are vital essentials and should be carefully considered.

Buildings located in the colder sections of the country are exposed to damages not likely to occur in more favored regions; precautions must be taken against frost and the damaging results of freezing. Where possible, the foundations should be placed at such depth as not to be affected by its action. Care should be taken during erection that materials or operations liable to be damaged by freezing are properly protected. Mortar that has frozen either in the bed, or in or on the walls is damaged, and by repeated freezing and thawing is rendered useless. Should it remain frozen until the moisture is practically expelled by the operation, and as mechanics say frozen dry, the damage in some instances is reduced to a minimum. Many varieties of building stones are seriously damaged, and some destroyed by action of the frost, especially if the original moisture of the quarry, called quarry sap, still remains in the stone. Soft or porous brick are also damaged, if frozen while containing water;—Water pipes, tanks, conductors, etc., etc., are all seriously damaged by freezing; in fact more damage is caused to buildings by the action of frost and freezing than by fire.

A serious damage quite frequently occurs in the use of metal in the construction of buildings from expansion and contraction due to the changes of temperature. An iron beam twenty feet long will materially lengthen during the Summer, and if rigidly anchored will push the walls apart. Other portions of the building or particles of masonry will adjust themselves to this change; with the return of colder weather the beam will contract, but the walls cannot return. This operation continuing will eventually cause the walls to fail or fall without any apparent reason: this is only a single example of the hundreds of silent influences continually in operation, quietly destroying our buildings. Another influence is the changes occasioned by the shrinkage of timber. Walls have been thrown down by the shrinkage of floor joist which are rigidly bridged against them. The shrinkage of each joist half an inch in width will correspondingly lengthen the cross bridging which may amount to feet in a long floor: All these are influences not to be ignored. Likewise dry floors tightly laid to the walls and securely nailed, if suddenly saturated with water will cause great damage, generally getting relief by breaking from the beams and bulging; if this is impossible the walls must give way: Thus the changes of heat and cold, and wet and dry, produce results which unless foreseen and

their counteraction provided for go on continually. It is a natural law, that as soon as growth ceases in anything disintegration commences, and frequently the two are in operation at the same time contending for supremacy.

In colder climates where heavy falls of snow are frequent, the increased weight of same, especially when wet, must be considered in the construction of roofs. Wet snow increases greatly in weight on roofs of flatter pitches; this is generally distributed unless affected by the wind, but on roofs with considerable pitch, the wet snow may accumulate in sections or on portions to such an extent as to crush the supports and break connections, causing leaks. There is also danger in thawing or melting, that the under or deeper portions of the packed snow will remain frozen, thus obstructing the flow of the water from same and flooding. Capillary attraction will draw the water up under the slate, tile or shingles, damaging the walls and ceilings materially. This frozen mass will also obstruct or break down the conductors and gutters. The proper, and possibly the only remedy is to place snow guards over the entire roof, consisting of small wire guards specially prepared and comparatively inexpensive which will retain the snow in position distributed over the roofs as it falls until melted: the water will thus be allowed to pass off as rapidly as melted to the gutter, effectually obviating all danger from flooding, crushing roof, or a serious danger to passers by where church is contiguous to streets of snow slides, often approaching an avalanche. The custom of placing a single snow guard at eaves to obviate this is often an occasion of more serious disaster. Plumbing appliances such as tanks, traps and water pipes are also exposed to dangers from frost, causing leaks and consequent damages. Steam and hot water heating apparatus are also sources of danger from same cause unless fires are maintained during the colder weather or water drawn off, either, liable to be neglected at the critical time, the damage resultant quite frequently being a destroyed or damaged apparatus, the repairs for which, aside from the damage to building may deprive the congregation of the use of the building for weeks. Precautions to prevent damage caused by carelessness or neglect cannot be taken only to the extent of reducing the risk,

Churches properly constructed are rarely destroyed by fire. except as caused by lightning, incendiaries, contiguous fires, imperfect apparatus or carelessness. This risk should be reduced to the minimum, by so concentrating all heating apparatus, that all fires, except that for illumination, are contained in one apart-

ment and that made fire-proof, with ample vent and every precaution taken against the conveyance of any fire or dangerous heat through the medium of distribution and flues. All channels for the rapid transfer of fire should be effectually stopped, especially partition and wall or furring spaces. As most buildings are constructed, they could not be better arranged for the conveyance and spread of fire to every part in the shortest space of time, scarcely giving the occupant an opportunity to escape.

As the markets afford every variety of building material,—experience, tests and research have demonstrated the advantages, properties, qualities and advisability of each, and the great competition and production has reduced the price of the best so as to enable it to compete with poorer grades. There is no longer any reasonable excuse for poor, cheap or unsafe buildings, and parties who practice the policy of economizing at the risk of the life, health or limb of their constituents or patrons, or for mercenary or selfish reasons are not performing their duty to themselves, their constituents or the cause, are morally responsible for the results; and if the reasons are ignorance or carelessness, they should be held financially, if not criminally responsible; as the ablest men and the best of materials are to be had for the asking, and at no materially increased price. So that ignorance of men, methods, customs, materials, risks, consequences or results is not an excuse. If only good, common-sense business methods should prevail, and personalities or sentiment be relegated to the back ground in church affairs, the results would be all that could be desired.

CHAPTER IX.

ANALYTIC.

MEN, METHODS AND MATERIALS.—COMMON AND UNCOMMON.

THE development of the relationship between the architect and the several professions and crafts, is but an exemplification of the progress of the world in all other lines. The profession has come under the law of evolution, and this law necessitates what scientists term "differentiation," which is a making of differences, the creation of a number of parts acting in unison, in place of a single individuality or organism, performing for itself all the necessary activities.

In the early ages, the architect was the *master builder*, not only designing the building but directing the craftsmen. It was his duty to train and instruct the men in the methods of using the various materials, which resulted in the various trades. New forms of buildings and construction rendered it necessary that he should investigate the principles, ascertain the stresses and strains resulting, and by a series of experiments, the strength of the various materials under different conditions, thus enabling him to construct and build safely and with economy.

First was evidently timber construction, then masonry, the change was gradual; many indications of this are to be found in the first attempts to use masonry in the same forms that timber was used; With no accurate knowledge of the strength of stone, —cements and mortars as yet undiscovered,—the first works were of the cyclopean character, where sufficient material was piled up to assure safety, spaces were covered with heavy beams, and openings were only of such size as could be covered by a single stone. When desiring to erect buildings of a more permanent or impressive character, the use of stone for covering was

deemed essential; intermediate supports became necessary which were secured by piers or stone placed on end, gradually assuming the form of a column as men became familiar with the strength of the material and as esthetic taste developed by reducing the quantity; resulting in the classic or trabeated architecture, in which the statical condition is one where all strains are cross strains and all pressures are simple vertical pressures. This style of architecture was centuries in developing and produced a perfect result which is still unrivalled and a model.

For the covering of greater spaces, either of interior or opening than could be spanned with the beam or lintel, inclined beams were first used, eventually resulting in the arch which consists of a number of pieces supporting each other over a void or space, narrower than their combined length if placed in a straight line, and which space they cannot fall through so long as they are accurately fitted, and so long as the walls which form their abutments remain unmoved. Thus was developed the arcuated system of architecture. In primitive cases the pressures were simple, while in its development the pressures became complex. There is much greater difficulty in making and recording test experiments on the strength and failure of arches than with beams or lintels.

The formulæ for calculating the strength of all materials, under all possible conditions and in resistance to all the various strains, are now in a complete stage, so that competent men can calculate to a certainty the weights they will bear with safety.

Thus constructive architecture is resolved into two systems, the *trabeated* and the *arcuated:* The principal feature of the former being the Beam or Lintel and the latter the Arch. The entire construction of the latter depending upon the stability of the arch, necessitates familiarity with the principles involved, as in all cases ample resistance to the pressure of the arch must be provided by some means, either massive walls, buttresses or ties. To secure substantial and safe buildings, the architect must be familiar with every class of stresses, strains and transfers. Mortars and cements now become a more essential part of construction, and the walls, composed of blocks of stone embedded in mortar became an integral mass of concrete.

In the middle ages the erection of one massive building was the work of a lifetime. But it must be remembered that at that period, and in fact in all periods preceding the present century, Architecture was a much simpler art than at present, and there was not called into service the varied

appliances that go to make up the modern building; there was no machinery to tax the ingenuity. Elevators were unknown; heating when used was of the most primitive character. Electricity had not been thought of save as a scientific plaything. Under such conditions the problems were of a limited character; the construction called for good, solid masonry and splendid examples are left us. Now however, the case is different; every appliance that mechanical ingenuity can devise is brought into use, new conditions continually arise requiring study equalling that of a new profession, and move so rapidly in their development that it is completely the work of one's whole time to keep abreast of progress.

This process of sub-division is one, the end of which is not yet reached, as the success of the whole depends on the perfection of parts, the great advantage of skilled specialists for each department, mechanical as well as esthetic is apparent. The various contractors and sub-contractors to the end of the list should be qualified and efficient, not depending on guarantees or bonds. The difference between the Architect's and the builder's methods and interests is that the architect wants to do everything as well as possible, both in material and design or leave it undone, while frequently the builder's interest is to do everything by coarsening and cheapening; their interests are antagonistic There are however conscientious builders, who faithfully endeavor to carry out the ideas and desires of the architect, even at a loss to themselves: such should be appreciated and commended, as otherwise the result may be superficially satisfactory, but under the surface may be many hidden mysteries which will develop at the most inopportune times and prove a constant source of annoyance and vexation.

The most artistic work does not consist of elaborate or ornate detail; the refined simplicity of true esthetic feeling, translated into visible form which appeals to all, is the end desired: coarse, elaborate detail or design only appeals to the vulgar taste; refined esthetic natures with cultivated taste are shocked with the bad taste and lack of harmony, and the adverse criticisms evoked ultimately cause a reversal of feeling, even among those who were first pleased. Never risk the opinion of any one not competent or qualified to give one; such opinions are almost always voluntary while those of value are rarely advanced without solicitation.

No people ever believed in their own country or age so heartily as we do in ours; Progress is supposed by everybody

to underlie all our activities. The thing done to-day must necessarily be performed better than that of yesterday. We rarely repeat without an attempt at improvement; advancement necessitates this. The world has moved more in the century just passed than in the thousand years preceding.

This is a very comfortable assumption, and a fact so thoroughly accepted that anyone who calls it into question is at once regarded as a cynic or pessimist or something equally odious. In the building trades, it is an article of faith that we have been moving along with the succession of day after day and are supposed never to have halted or retrograded.

There is much to warrant this belief as well as to create it. The application of mechanical power to building operations has made possible many wonderful things, all carried on under our own eyes. The adoption of iron or steel to construction has been revolutionary; this with the discovery of artificial hydraulic cement has made creations possible that were heretofore visionary. Work can now be accomplished in a year that in the middle ages would have taken a score.

There are directions however in which this progress cannot be conceded unreservedly; it is doubtful whether in all particulars modern mason work can be compared advantageously with the best mason work of medieval times or with that of the Romans, the Greeks, or the other great builders who preceded the Middle Ages.

For instance, take one of the oldest pieces of mason work, the great Pyramid of Khufu in Egypt. Investigations demonstrate that the stone in this colossal structure is cut and set with a mathematical exactness, which can only be compared to the finest achievements of our best mechanics and artisans in optical and mechanical work and to which modern masonry cannot be compared.

The greatest achievements of our own day have been in steel construction, rather than in mason work. In our own country the mason's craft was for a long time in a decidedly low condition: This was natural, as the history of American building began rather with the carpenter, and the frame house, and was almost completely in the carpenter's hands until the beginning of the present century. The growth of cities during the present century has brought the mason to the front in the more general use of stone and brick. For years the use of brick was predominant, despite the immense wealth of stone which this country possesses.

In consequence a class of artisans and craftsmen has arisen with us, as different from the old order as the architect of to-day is from the old mason-carpenter Architect, of even the early days of the present century. These men follow their calling in a scientific way; they possess experience and means. They have gathered around them a body of skilled workmen who are competent to meet the most exacting demands of the modern Architect, and one needs very little technical knowledge to be aware of how exacting these demands are.

The marshaling together of the men and materials that enter into the construction of a large modern building may be likened to the mobilization of an army and the supplies for its sustenance. In the selection of the various materials from all sections of the country, as well as the mechanical and artistic talent and ability essential to the final completion, all the innumerable resources of the country are available and tributary.

There are no materials used in the construction of a building that are of more importance than the mortar. While most people would put many other things before mortar which really are not comparable in importance, the practical man not only knows that the physical bulk is one of the largest elements, but that habitableness, stability and even the sanitary perfection of a building depends in no small measure on its quality, especially that used in the plastering. Lime or cement paste is the cementing substance in mortar, and its proportion should be determined by the rule—*That volume of cementing substance must not be in excess of voids or spaces in the sand or coarse material of which the mortar is composed;* lime is formed by calcining limestone, marble, shells, etc. *Hydraulic limes* are those which harden under water; the best grades set in 2 to 4 days and in a month are hard and insoluble, and at the end of six months may be worked like stone. Inferior grades take much longer. *Artificial hydraulic lime* will never attain the same degree of strength or hardness that natural hydraulic limes do. All hydraulic limes depreciate by exposure to the air; paste made of ordinary lime shrinks in hardening consequently cannot be used without a large portion of sand. The coarser sand, having larger voids, makes the best mortar as allowing more cementing paste. *Natural hydraulic cements* contain a larger proportion of silica, alumnia, magnesia, etc., than do the limes, do not slack after calcination, and are superior to the best hydraulic limes in that they will set under water in as many minutes as the limes take hours, do not shrink in hardening, can be used without sand, but deteriorate rapidly when exposed to air.

As cement mortars often set too rapidly for practical use in masonry, lime is often added to retard the setting, still giving the advantage of cement mortar, thus: a good mortar for stone would be composed of 8 parts cement, 3 of lime and 31 parts of clean, coarse, sharp sand: the same for brick only using less sand.

Mortar for plastering consists of *coarse* and *fine stuff*, *gauge stuffs* or *hard finish*, and *stucco*. *Rendering* is coarse mortar applied to brick walls direct. All *coarse stuff* consists of lime paste, coarse sharp sand and hair or fibre to give the mass texture and tenacity, as fibre is preserved by lime while hair is totally destroyed, a good quality of fibre is preferred to hair. The first coat of three coat work is called the *scratch coat*, the second the *brown coat*, and the third the "finish." In many instances the second coat is applied before the first is set, thus combining the two as one rather than applying separately. *Fine stuff* is composed of lime paste, and is mixed with fine sand for "Sand-finish" or with Plaster Paris for gauge stuff or "*hard-finish*," in either event troweled down hard and smooth. For decorative purposes, especially in churches the sand finish troweled down with a cork or felt float is the best; stucco is "gauge-stuff" or lime paste and Plaster of Paris and is used for all modeled work, mouldings, beams, cornices, etc. The best of results can be obtained and time gained by the use of prepared cement plasters; the great desideratum to be attained as a plaster finish for all walls and ceilings, is something that shall be harder, stronger, more cementitious and less porous than the average lime and hair plaster heretofore used; all mortar should be of the best materials, properly proportioned and thoroughly mixed, hence the advantage of all machine mixed mortars.

White Alkaline efflorescence upon the surface of brick walls is generally the result of some character of magnesia or similar salt contained in the brick or mortar, combining with free sulphuric acid with which our air is impregnated, forming sulphate of magnesia. This may be neutralized by the addition of animal fat to the mortar or by the use of special preparations to prevent this. It may be prevented by dipping the brick or painting the walls, but should the crystallization take place within the pores of the brick, being confined by the paint will cause disintegration of the brick.

Grouting is mortar in a semi-fluid state which may be poured into the interstices of the wall after each course is laid: Concrete is a mixture of cement and sand, with coarse materials such as gravel, pebbles, stones, shells, broken-brick, etc. Two or more, or all of them may be used together in the proper proportions and

should be thoroughly rammed to insure the filling of all interstices, and allowed to set before loading. Lime should be slaked at least one day before mixing with the sand, and when they are thoroughly mixed the mortar should be heaped and left in one mass covered to *prevent evaporation;* the longer it stands before using the better the results; for plastering at least thirty days should elapse, but in no case should be allowed to *set* before using.

It is superfluous to say that the choice of stone for a building intended to be durable, is of the very highest importance. The requisite qualities being hardness, tenacity, and compactness.

The term *free stone* is used in an arbitrary way and indicates any stone that can be cut with a chisel and mallet or saw, as distinguished from the harder stones which can only be dressed with a pointed tool.

Free stone includes the two great general divisions of Sandstone and Limestone. The causes which destroy stone are decomposition, and disintegration, the former effecting a chemical change, the latter a mechanical division or separation of parts: the effects are much modified by the location whether in city or the open country, the atmosphere of the city impregnated with the gases of combustion and other gases, accelerating decomposition much more rapidly than the country air.

Stone should always be thoroughly seasoned, that is the quarry sap should be completely evaporated before using, and should always be placed in the natural position, *i. e.*, on its natural quarry bed, never on edge. This alone will double its durability, and all projections should be undercut. Color is also of importance in selecting the stone, as the color effect of a building has much to do with its character.

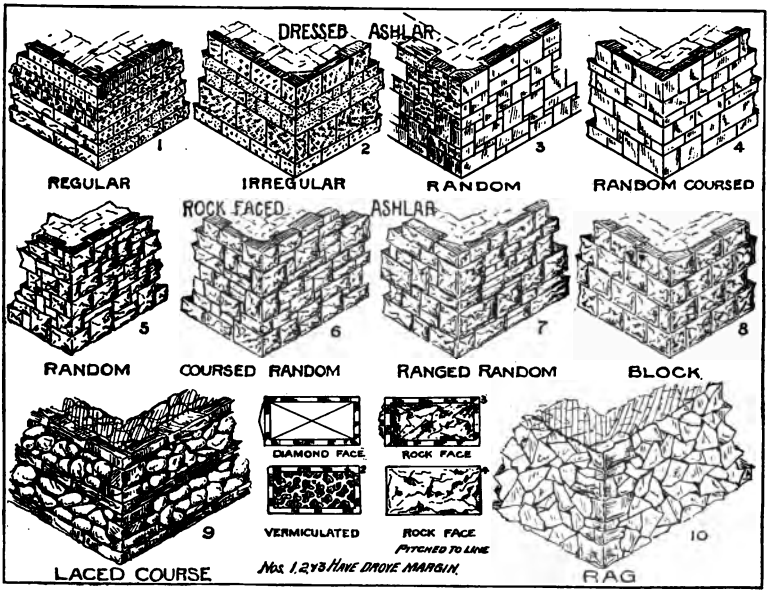
The varieties of building stone available and used, are the various varieties colors and characters of Sandstone, Limestone, Granite, Gneiss, Bluestone, Marble, Serpentine, etc.; the most durable of those available in the locality should be selected, with due reference to color effect. Authorities differ largely as to the life of the various stones. The following may be taken as an average, according to locality in this country and the quality of stone.

Brown stones from 5 years to 75 years, Blue stones 75 to 150 years, Sand stones 30 to 100 years, Lime stones 20 to 75 years, Dolomite 20 to 70 years, Marble 50 to 150 years, Granite and Gneiss 30 years to 100 years.

Artificial stone — properly speaking — would include burned clay, as well as that formed of silica combined with cements; Burned clay including Brick and Terra Cotta of all kinds and

Tile. Of the varieties of brick we have the common hand-made, the machine-made, pressed and repressed, standard and Roman shapes, and all forms of moulded brick, and of nearly every conceivable shade of color. Terra Cotta can be moulded and modeled in every conceivable form and color, all should be selected with due reference to strength as well as durability.

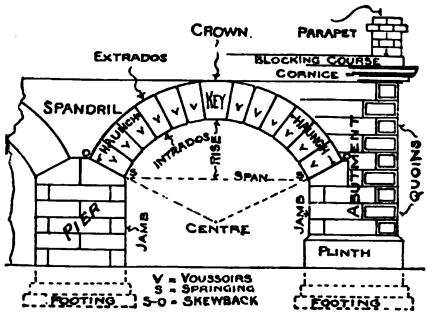
Stone masonry is classed as rubble and ashlar. *Rubble* masonry is composed of small stones, irregular in form and rough. *Ashlar* is composed of blocks of stone dressed square and laid with close joints. *Coursed ashlar* consists of blocks of the same



height throughout each course. *Rubble ashlar* is ashlar face stone with rubble backing. The above cuts illustrate the technical terms used in describing walls laid in various ways.

Bond is an arrangement of stone or brick overlapping, so that vertical joints between the stone or brick of one course do not coincide with those of the one above or below, and is observed in the width as well as the length of wall. A *header* is a stone or brick laid with the end to face of wall. A *stretcher* is a stone or brick laid parallel to face of wall. Headers and stretchers are laid single or in courses. *English Bond* is the laying of headers

and stretchers in alternate courses, and *Flemish Bond* is laying of headers and stretchers alternately in the same course. Most stone should be laid with their strata horizontal and in the natural position. Weak-stone should not have a length to exceed three times their depth; strong stone may have a proportion of twice this. *Quarry* or *Rock* faced is the natural, undressed cleavage, and when the arris or angles of face, sides or ends is defined by a tool to show a right line, is called *pitch-faced.* When a narrow margin is chiselled around the edges of face of rough stone it is called drafted, or *drafted margin.* Any stone that is squared, having dressed sides and ends, is called *cut stone;* if the face is finished with a pick or heavy point it is called *rough pointed* or *pick faced:* to follow with a finer tool would be called *fine pointed.* Finishing the face to a plane surface with the stone hammer or ax is called *hammer dressed or axed.* Dressing the surface with a hammer, the face of which is serried with sharp edges is called *crandalled;* when repeated at right angles is called *cross-crandalled. Bush-hammering* is a species of crandall finish. Drove work is finishing with a chisel in parallel strokes, generally from 5 to 10 per inch. *Rubbed work* is dressing the surface to a perfect plane and rubbing with sandstone and water until all tool marks are eradicated.



The *footing* of a wall is a projecting heavy course to increase the base or distribute the weight over an increased area. *Plinth* is a projecting base to a wall. A *quoin* is one of the blocks forming *external* angles. A *retaining wall* is a wall to resist the thrust of contiguous earth. *Parapet* is a low wall over the edge of a roof or terrace. A *blocking course* is a course placed on top of the cornice. The *span* of an arch is the width of an arch from spring to spring. The *springing* of an arch is the point on each

side from which it starts or rises. The *length* of an arch is its span. The *rise* of an arch is the height from springing line to the underside of the centre, or highest point of the arch. The *crown* of an arch is the highest point at the top of arch. The *haunches* of an arch are the sides from the springing half way up to crown; the *extrados* is the upper and outer surface of an arch. The *Intrados* is the inner or lower surface, sometimes called the *soffit*. An *abutment* is the outer body from which an arch springs. A *pier* is an intermediate support. *Jambs* are the sides of abutments or piers. A *skew back* is the upper surface of a pier or abutment from which an arch springs, with its face on a line radiating from centre of arch. The *spandrel* is that part of a wall between an Extrados — a vertical line drawn from the upper end of the skew back, and a horizontal line extended from the crown. The *voussoirs* are the blocks forming the arch, the central voussoir being termed the *Key*. A *re-entered angle* is the reverse of an *exterior* angle, and a *reveal* is that portion at the side of an opening in front of the recess for a door or window frame.

Brick should be well wet before laying; a common burned brick will absorb about one-sixth of its weight, or a pint of water, while a good hard brick should not absorb beyond $\frac{1}{18}$ of its weight. The volume of water a brick will absorb is inversely a test of its quality.

The color of brick depends upon the composition of the clay, the moulding sand, the temperature of the kiln, and the volume of air admitted.

Pure clay will burn nearly white. The presence of iron in the clay produces red, orange or light yellow, according to quantity. Oxide of iron mixed with pure clay will produce a bright cherry red; exposure to an intense heat will produce a blue or purple, and the addition of manganese — in proper proportions — will produce a black, brown or gray. Thus it is possible by the proper mixtures of the metallic salts or alkalies to produce any shade or tone of color, without injuring the quality of the brick. Brick are moulded in all shapes, and of all sizes. Various forms of hollow brick and tile are made to reduce weight, and used for furring, fire-proofing floors, partitions, etc., as well as the encasing of iron and steel work for protection. Blocks are formed of a mixture of clay with sawdust, the sawdust carbonizing in the kiln leaves the block porous so that nails can be driven into it similar to lumber, hence the name terra-cotta lumber, used largely for fire-proof roof coverings as well as partitions: Slate can be nailed direct to these slabs, the nails holding as well as in boards.

Architectural Terra Cotta is baked clay, modelled to any desired form for building purposes, and by a mixture of the proper ingredients acquiring any desired color. It is practically imperishable, does not represent any other material when properly used, and is not therefore an imitation of wood, stone or iron. It is one of our most desirable and durable building materials, having its own quality and purpose, and when used ought to be recognizable. Used in connection with brick, effects are possible which the cost of stone, the rusting of iron and the danger of wood practically debar in these other materials. The facility with which it can be formed and modelled in the plastic state, and afterward burned to an imperishable material, make this one of our best decorative and most useful building materials. The same properties pertain to the use of burned clay in every form, including tile for floors and roofs.

Much of the material used in the construction and finish of buildings in this country is still necessarily wood or timber, which is classed as hard and soft woods. The hardest and densest woods are least subject to decay, but are more liable to split or warp in seasoning.

Seasoning is the extraction or dissipation of vegetable juices and moisture, or the solidification of the albumen. Wood requires time to season in proportion to its density. Green wood contains on an average from 40 per cent. to 45 per cent. of its weight in moisture, and when seasoned contains from 10 per cent. to 15 per cent.

Gradual or natural seasoning is more favorable to strength and durability. Water seasoning is total immersion in water for the purpose of dissolving the sap; this renders it more brittle but is less liable to warp or crack. Air or natural seasoning requires from two to eight years according to character and dimensions. It should be used as soon as seasoned, as it is liable to deterioration as soon as thoroughly seasoned. Various methods have been proposed for hastening the process, as steaming, kiln drying and the various processes of impregnating with chemicals which hardens and preserves the wood by securing it from dry rot and attacks of worms. Steaming with some woods if properly applied, is a success. Kiln drying is only suited for boards and pieces of small dimensions as it is apt to cause cracks and impair the strength unless performed very slowly. Timber is subject to common and dry rot. The former is occasioned by exposure to alternate moisture and dryness, and progresses from the exterior, can be prevented by protection, generally by the use of

some paint. If this occurs previous to its use it should be rejected, as its strength is impaired; when undetected by any other method it can be by a quick blow.

Dry or sap rot is inherent in timber and is the putrefaction of the vegetable albumen which is fed on by insects or fungi. Fungi is the general form by which dry rot is known, and the threads may penetrate and affect the entire piece of timber. Sap wood contains a large proportion of fermentable elements. The strength of wood impregnated for its preservation is not reduced, while its resilience is improved.

In a perfectly dry atmosphere and under proper conditions, the durability of the best woods is almost unlimited; rafters and timbers of roofs are known to have been in use over a thousand years, and piles submerged in water almost an equal length of time.

Charring, painting or covering the surface of wood not seasoned, is highly injurious, as it prevents the drying of the interior, in consequence of which, fermentation and decay soon take place. Good ventilation and dryness are essential; more will be said concerning the strength of timber under constructional engineering.

As a rule, there is probably less knowledge of slate than any other building material employed in the construction of buildings. A slate roof is specified which is supposed to fill the requirements. A good slate roof, if properly laid, will outlast any building on which it is placed, while a poor one may not last more than ten years and is in continual need of repairs. The good roof and the poor one may have the same outward appearance when first laid, and to the superficial observer be the same, but time will soon show the difference. Black slate or properly a very dark blue is probably the most enduring and is the favorite; it is obtained in the States of Maine and Pennsylvania. Red, purple, unfading and sea-green slate are quarried in Vermont and New York. All colored slate should be very carefully selected to preserve the color after exposure, and are used to secure color effect in the roof. Sea Green slate are tough, but fade several shades in color, often producing unpleasantly spotted roofs. Slates are cut to standard sizes, and for a good roof should average at least $\frac{3}{16}$-inch in thickness. Nail holes should be drilled and countersunk rather than punched and each slate should be secured with galvanized iron or copper nails, laid on roofing felt and cemented to secure a perfectly tight durable roof. On fire-proof buildings the slate should be laid in a bed of cement. Slate is a species of

argillaceous stone; is an abundant and most useful mineral. Good slate should have a metallic ring when struck, and the more dense the more enduring, hence one test is the absorption of water, the better slate absorbing the least. In some slate there are clay veins, which rapidly disintegrate, these are called ribbon slate.

Tin is very extensively used for roofing and may be divided into three general classes, "Charcoal bright," "Coke bright," and "Terne" plates; the two former are thin sheets of steel coated with pure tin. Ternes are thin sheets of steel coated with a mixture of tin and lead. Bright plates are principally used for tinware, roofing plates being mostly terne in which the greater the proportion of tin the more desirable. There are a few brands of roofing plates in the market that are coated entirely with tin: The steel sheets are rolled to three standard thicknesses, I. C. or no. 29 guage, IX. or no. 27 guage, and IXX. or no. 26 guage, and if of same brand are each supposed to receive the same coating. Before coating, the plates are washed in dilute acid to clean and remove scale, then rolled, pickled and washed. Just before being immersed in the tin or terne mixture, the plates must be passed through a flux to cause the coating to adhere perfectly. An oil flux is conceded the best known, but is more expensive than the acid flux. The original or old method was to use a suet flux and to dip the black plates into the melted tin or terne by hand and allow it to absorb all the coating possible. The modern and more general method is to pass the plates through an acid flux, dip into the tin or terne and then pass through rolls removing all but a scant coating. Such plates are the most expensive as they will last but a short time. The only safe guide is to specify a guaranteed brand known to be good, of full weight and of which each sheet is stamped with the brand and trade-mark.

A roof of good terne plates well put on and kept properly painted should last from thirty to forty years; a poor plate may give out in two or three. A tin roof should be laid on waterproof felt, and is put on in two ways, the flat lock or flat seam, and the standing seam. The former is used for flat and the latter for pitch roofs. Tin should always be fastened to the roof boards by cleats and never nailed through the sheets, and the flat seam should be thoroughly soldered. All tin roofing should be painted one coat on the underside before laying, and have two good coats in the upper side as soon after laying as possible. Galvanized iron is soft steel plates or sheets coated with zinc and is used largely for gutter, roof and cornice work.

For the best class of work copper is often used; it is the most durable of metals and requires no painting. It is also used largely for cornices and exterior work for the better buildings and for roofing. For flat roofs twelve ounces and for valleys and flashings fourteen ounces to the square foot is used, and is laid the same as tin, but with brass or copper nails: with copper at twenty cents per pound it will cost about three times as much as a tin roof. Lead is rarely used for roofing except as flashing, on account of its expanding and contracting so much under changes of temperature.

Steel construction is a modern innovation, revolutionizing all principles and theories concerning building, and making now possible what has heretofore been deemed impossible, economizes space as well as largely reducing the quantity of material used. Buildings now erected are equally, if not more stable than the solid masonry structures previously erected. All matters pertaining to steel construction, properly belong to constructive engineering and will be there treated.

The interior finish of a building, especially a church, is of much less importance than the constructive portion, yet the impressions are largely influenced by its character and the care exercised in minor details. Hardwood is mostly used, should be select, clear and thoroughly seasoned. Doors form an important part of the finish, and often give more trouble than any other. All hardwood doors should be veneered on a pine centre or core, which in the best work should be laminated. In the Combination Church, the two auditoriums are connected by means of movable doors of some character, either to operate laterally, vertically, fold on each other or roll on a cylinder,—or large heavy curtains may be used. Owing to the great size of the doors—in some instances the opening having been made thirty feet high by sixty feet in width without any intervening columns,—the doors become quite heavy and should operate on special floor tracks and on specially constructed anti-friction sheaves: when properly equipped doors which may weigh nearly a ton each can be very readily and easily moved. Secure foundations must be provided with means for adjusting the track and overhead guides until the building has thoroughly settled, the heavier and larger doors should all operate laterally in pockets. Flexible doors may be secured for moderate sized openings which will wind on a roller, either operating laterally or vertically also a door folding on itself similar to inside window blinds—hung overhead.

Guillotine doors or doors elevating by any means and balanced by weights should never be used, no cables or cords can be had which will not break some time or the necessary machinery fail; such breakage may result in a serious accident. If the door should drop into the basement and disastrous results from an accident be impossible this kind of a door may be admissible. All stock for the interior finish should be prepared in the shop and not brought into the building until it is thoroughly dry and clean. Large surfaces exposed to dampness on the back should be protected by a coat of rough paint. All the various fine woods of the country or of the world are available in infinite variety, and may be used solid or in veneers, plain or carved and moulded, quartered, bastard or otherwise sawn, and finished natural, stained, painted or enameled, the whole matter being a question of taste and judgment.

Most of the finished hardware used about buildings is made of cast iron, wrought iron, steel, bronze or brass, nearly all the cheaper grades being of cast iron. The cheapest finish is ordinary black varnish or Japan. The various so-called bronzed finishes are a sort of Japan or lacker, in which metallic powders have been mixed, is a very good imitation of bronze but not lasting. Iron hardware is often electro plated, either copper, bronze or nickel and buffed. This also tarnishes in a short time and cannot be re-polished. The most appropriate finish for iron is a natural black iron color which is rustless and may be polished, called *Bower-Barff*. Bronze is more largely used than brass; both can be cast in the most intricate or ornate patterns and finished in a great variety of colors. As a rule figured bronze hardware trimmings are cheaper than the plain, and for churches the antique effect or ecclesiastical detail are the more appropriate.

There is probably no department of building more difficult of control than the painting. The adulterations are innumerable and difficult to detect, each manufacturer insists that his process and system of manufacture is the only perfect one, and his goods the best. Each painter has his favorite and is prejudiced against others. In general all paint consists of two parts, the base or body, and the liquid or vehicle, with some coloring matter added and some material to hasten the drying. The materials forming the body are white and red lead, zinc-white, oxide of iron, yellow ochre, lamp-black, plumbago, etc., and without question, linseed oil is conceded the best vehicle. Turpentine is largely used to thin the paint and often as the vehicle for interior work; it

should not be used on exterior or on metal. Dryers are substances added to paint to cause it to dry more rapidly,

The pigments used to give color and opacity to paint are principally obtained from natural earths and products of animal or vegetable substances all fading more or less after exposure. Much of the beauty of the natural woods used for the interior finish or the furniture depends on the final treatment. All porous woods should have the pores filled full and solid. The filler should be of such texture or substances as not to rub out in the finishing processes, and should be transparent so as not to change the character or appearance of the wood and is best if applied in a liquid or paste form. The quality of varnish should be adapted to the various uses. The durability of varnish is of the utmost importance; it is also essential that the best should be used and properly applied. In the event that a poor varnish should have been used, and the same should prove imperfect and require renewal or refinishing, new varnish cannot be placed over the old, but the old must be removed, often at a greater expense than the cost of material and application. For all standing finish and parts difficult of access, the best elastic finish should be used, while for the pews and parts with which the person comes in contact, a hard unelastic varnish is required. Great care should be taken in adapting the character of finish to the various exposures or uses. The labor, of preparation, application and finishing is the larger part of the expense, therefore the only saving between a best grade and an inferior grade of varnish lies entirely in the material, and will prove inappreciable, compared with results. The best interior varnish made will never serve to use on the exterior doors, while varnish especially prepared for exterior exposure would totally fail if used for the pews. This same rule of adaptation will apply to all classes of material and labor in connection with a building. Copper may make the very best roof but would never do for a column or beam, although a metal; Cast iron makes a good column but a poor roof, etc., etc.

CHAPTER X.

ENGINEERING.

HEATING and VENTILATION—SANITARY, ELECTRIC and CONSTRUCTIVE.

Section 1.—HEATING and VENTILATION.

IN the first years of the Colonies, the custom of building churches without any arrangements for warming was quite common; many of the people coming from a distance spent the time between the two services at the parsonage. To mitigate to some extent the rigors of the severe cold the floor of the meeting-house was sunk below the ground and the roof descended to very low eaves; this custom was very general and was doubtless brought from Europe, where one may yet sit through services in fireless churches.

Early in the eighteenth century foot stoves were sometimes carried by the servants of the better class. Sometimes a small room was provided in which a fire was maintained to which the weak, sick or aged could retire to warm and again return to services. Some exceptional churches had iron stoves as early as 1730, although the most of them resisted until after the beginning of the present century.

A SABBATH-DAY-HOUSE was sometimes provided to accommodate those who came from a distance, which was a small house with accommodations for the shelter of a horse or two at one end and the family at the other; there they could have a fire, eat their luncheon and remain between services. Sometimes two or more families occupied these houses together, when there was often two rooms to separate the sexes, social converse between boys and girls not being permitted during this consecrated time.

With the advance of civilization more attention is paid to health and comfort, and it is not deemed necessary to live a life

of penance in this world to secure more of the comforts in the next. In some climates and seasons, the natural supply of heat is not sufficient for physical comfort, and artificial heat is essential. In its physical relation, heat is recognized as a bodily sensation, by means of which we determine by comparison that one body is warmer or colder than another. To heat apartments by artificial means implies its *generation*, its *transmission* and its *diffusion*.

To intelligently arrange for the generation of heat, we should ascertain what it is and how most economically produced. At one time heat was considered a material substance which might enter into and depart from a body by conduction; the terms now used were formulated in that connection, hence their application is misleading. It is now thoroughly established by fact and experiment that heat is a form of energy, similar in many respects to light and electricity, capable of being reduced to either, or to work, and is governed by fixed laws.

To determine the *amount* of heat generated, we must have a standard measure of quantity, called the heat unit which is the amount of heat required to raise one pound of water one degree Fahrenheit at a normal temperature of 60 degrees, and to determine its *intensity* we must have a standard measure of degree, which is obtained by dividing the difference between the freezing point and the boiling point of water into 180 equal parts called degrees known as Fahrenheit's scale; these standards are adopted by all English speaking and many other countries.

Prior to heating or warming any building it should be thoroughly flushed with pure air. It may be of advantage to warm the air contained in the building on first starting fires, passing it over the heated surfaces again and again; this will greatly aid in warming the walls and objects of the apartments, and is termed revolving the air, but when the room is filled with living, breathing and perspiring people an abundant supply of fresh air is essential, with the foul air sent out where it will not be used again until it has lost its load of impurities, this is ventilation. Buildings are warmed by *stoves*, *furnaces*, *air warmers*, *hot water* and *steam*. Only in extreme cases or for small apartments should the matter of warming by stoves receive any consideration. With the use of the hot air furnace most people are familiar; they should be of ample size to avoid over-heating, securely connected and provided with an ample supply of fresh air. Proper precautions must be taken as regards safety, all hot air pipes must be of ample size and thoroughly protected. As

heat is the motive power of air with this system, the furnaces should be located central or as near the portion to be warmed by them as possible. As it is evident that *the heated air cannot pass into the apartment without a corresponding amount of air is taken out*, and as the removal of *contaminated air is essential*, provision must be made for its removal by some means. *Aspiration*, or by a heated flue is practically the only system which can be used in connection with the furnace.

The *Modern Air Warmer* has abundant surfaces of tubes, flanges or gills exposed to the air as it enters fresh and continuously from the outside, and the heat of the fire, diffused as it is throughout the whole of the exposed surface, cannot make any of it intensely hot. The theory is to *warm great quantities of air* rather than to *heat a small quantity*. The distribution is similar to the furnace. With steam and hot water heating, the methods observed and principles involved are much the same; in both, the boiler is placed in the basement of the building where the heat is generated, thence by various means conveyed to the apartments and diffusion provided for, generally by what is commonly known as radiation which is of three kinds, direct, indirect and a combination known as direct-indirect. A room is warmed by *direct radiation* when the air in it is brought into direct contact with a hot surface, either pipes or some of the various forms of radiators, located in the apartments to be heated, with no arrangements for fresh air supply in connection. This feature lays the system open to the very serious objection that the same air is warmed and used over and over again; warmth may be secured but at the expense of health. Sometimes pipes are placed under the pews: this is a deplorable method of warming, as the foul airs and odors from the boots, shoes, rubbers, wet and often muddy clothing,—especially during inclement weather—combined with the foul odors and emanations which exist in the lower part of the apartment coming in contact with the steam pipes become heated and ascend into the faces of the occupants of the pews. In sweeping and cleansing the rooms, the dust deposits in and about the pipes which foulness is put into circulation: for sanitary reasons, this system should not be considered by any people having regard for their health or comfort.

Direct radiation should not be used or considered in connection with any apartment occupied by an assemblage of people, except as supplemental to some system whereby an abundant supply of fresh pure air is assured. A room is said to be heated

by *indirect radiation* when fresh air is passed over a heated surface before entering the room. Indirect radiators are placed under the locations where heat is desired and the heated air conveyed thereto through ducts. An abundant supply of fresh air to each is essential, the flow depending entirely on the motion imparted by heat expanding the air.

Indirect heating is frequently accomplished by concentrating all radiating surfaces in one location, connecting with an ample supply of fresh air and distributing the warmed air by means of conduits or ducts to the various apartments to be warmed, similar to distribution from a furnace by gravity. With the *direct-indirect* system some form of radiator is used having provision made in the base for the introduction of fresh air, generally from the outside. This system as well as the indirect is practically inoperative without some provision for the removal of an equal amount of foul air from the room. These are the available methods of heating by observing natural laws, and without the aid of any mechanical device to move the air.

Heat may manifest itself in one of two ways, namely as temperature and as expansion or energy. All heat generated by the burning fuel will appear in one or both of these forms. Water at the normal pressure can only be heated to 212 degrees Fahrenheit, but if confined will *absorb* nearly 1000 degrees in vaporizing which *will not show as temperature* and is known as *latent heat;* condensing this vapor or steam however releases this latent heat and it can then be utilized for warming. In this property lies the great value of steam as an agent for heating. Certain mechanical work must be performed however in forcing the steam to the remote localities through small pipes and the water of condensation back to the boilers.

As there is always a certain amount of danger in connection with the use of steam and hot water, generally the result of inattention or carelessness, sectional safety boilers should be used which will reduce or obviate this risk. During cold weather water occurring in pipes or radiators is liable to freeze and burst, ruining plaster and furniture; repairs are expensive and take time. There are also many pipes, valves and other paraphernalia essential, all of which require attention and to avoid closing the house during a part of the Winter should be completely overhauled and tested before cold weather each season. In some instances the combination furnace—a combination of steam or hot water with warm air—is used with the best results.

The methods available to produce ventilation without mechanical appliances are two; first, *natural*, second, by *aspiration*.

NATURAL VENTILATION depends on the difference of temperature between interior and exterior, and the force of the wind. Notwithstanding all that is claimed for this system by the various curiosities of advertising, such ventilation is as variable as the wind itself, and must be thrown out of court as unreliable; this is generally attempted by flues, a system of openings and valves, or some form of patent ventilator.

By ASPIRATION is meant the extraction of foul air by heated flues, shafts or chimneys; heated air expands, becomes less dense, and has a tendency to rise, being forced up by the heavier cold air flowing in below which is the force really bearing it up and creating the motion. Air has *weight* and it requires force of some kind to move it. The value of flues for this purpose has been much exaggerated and over estimated. A difference of temperature between the flue or shaft and the external air *must* be maintained: thus, in a flue 50 feet high with a difference of temperature of 10 degrees, 240 feet will pass per minute, while with an excess of 50 degrees 540 feet will pass; (this indicates velocity.) *To secure constant, uniform ventilation, the difference of temperature must be maintained on which the capacity of flue has been calculated*, thus while in cold weather a difference of 50 degrees may easily be maintained, in the extreme weather of Summer it is nearly impossible. The idea prevails that there is always a draught in flues or high stacks; this is not the case. *There can only be an upward current when the air of the flue is of a higher temperature than the external air*, although a slight current may be induced by winds blowing across the top, or the heat of the sun on the upper exposed portion of the chimney rarefying the contained air, by this method there must be unrestricted openings and due allowance for friction, approximately 50 per cent. Air expands one part in 460 for each degree of temperature.

Air will pass through porous walls and the many crevices in construction at windows, doors, etc., all of which aid in ventilation, quite frequently resulting in unpleasant currents or draughts. It has been ascertained by actual test that 7 cubic feet of air will pass through one square yard of common plastering per hour at a difference of interior and exterior temperature of 30 to 40 degrees. The various patent plasters however are practically non-porous, and the steel ceiling entirely so. There is no power or force in the volume of warm or hot air entering the apartment from the

furnace aside from that given by the difference of temperature, although sometimes given prominence in the advocacy of so called natural systems. *To secure uniform, continuous ventilation by these methods would require constant attendance of the rarest skill and judgment backed up by an infallible thermometer.*

The air in the flues may be heated by various means to *induce* a current, sometimes by a steam coil, sometimes by a small furnace at base of flue, and sometimes by gas jets; as the conditions are not alike two days in succession the amount of heat must vary and be regulated daily and is rarely equal to its theoretical value.

Having thus ascertained how unreliable any system of ventilation will prove that relies on natural laws or aspirating flues without *competent skilled attention*, and how when most necessary is liable to be inert, the natural conclusion is reached, that to secure *positive* results mechanical means *must* be adopted.

MECHANICAL VENTILATION is produced by the action of fans creating an air movement; regular, unvaried and in stated volumes, removing the foul air as fast as vitiated and forcing in fresh pure air to take its place. This fresh air should be warmed to the proper temperature for comfort before entering the apartments; this is done by three methods. By the Air Warmer, by Steam or by Hot-water. The fresh air supply should be elevated above the earth gases or street impurities and remote from any foul air or smoke flues. Warmth is imparted to the air by passing over the surface of the air warmer or over coils of steam or hot water pipes. There is diversity of opinion as to the proper location of the fan, whether it should *force* or *exhaust* the air over the heated surfaces; *air should never be exhausted over surfaces heated directly*, and the consensus of opinion is in favor of maintaining the generator in a plenum wherever possible with any system; in either event the air is brought through the duct, passed over the heated surfaces and distributed through conduits to the various localities in the apartments to be warmed, provisions being made whereby the air can be passed *by* the heating apparatus in *whole* or in *part*, thus allowing perfect and instantaneous control of the temperature. In the most carefully installed apparatus a double pipe or conduit is carried to the base of every rising pipe, one part containing warm the other cold air, thus by turning a valve either warm or cold air may be turned on or mixed to any desired temperature, but unlike the ordinary warm air systems in which, if the air is too hot the only remedy is to shut it off, with this system the air supply is continuous and the temperature under

perfect and almost instantaneous control. The fan used for supply should be of such power that a slight pressure could be maintained inside the rooms, which will thus counteract any drafts occasioned by openings of doors or windows. The inlet register should be located about 8 feet above the floor so that no perceptible or unpleasant currents should be felt by the occupants. For halls, vestibules or corridors the air may be brought in through pedestal or base registers which are more pleasant in inclement weather, sometimes for more perfect diffusion and distribution, the supply is brought into auditorium through small registers in the ends of the pews. In the larger buildings *two* fans are sometimes used, one forcing in a supply of fresh air and the other withdrawing the foul, vitiated air; the supply should *exceed* the eduction in order to maintain the internal pressure.

This system of moving heated air by mechanical means is generally known as the Hot Blast System. The number of heat units resulting from perfect combustion of various fuels has been ascertained (the best apparatus only utilizing about 50 per cent. however). By determining the amount of air required per hour to maintain purity, and the raise of temperature desired, we can ascertain the heat units necessary, which will indicate the amount of fuel, also the size of grate for its combustion, and the flue to carry off the products of combustion as well as the size of fan and velocity necessary to move the air, thus everything can be definitely calculated and provided for. For economy we move the air at the highest rate of speed practicable, thus reducing the size of ducts and getting the air to the apartments as quickly as possible. The registers should be such as will offer as little resistance as possible to the passage of air. A velocity greater than 450 feet per minute at the register is unpleasant. Air will absorb sufficient heat in passing over heated surfaces of proper form at a velocity of 1,500 feet per minute. Hence an initial velocity of air at fan and over heated surfaces of 1,500 feet should be provided and the size of ducts determined accordingly; doubling the area of the rising ducts will reduce the velocity one-half; doubling the register and register box will again reduce securing the desired velocity at register, diaphragms for regulating and adjusting the distribution must be provided at each branch, also valves to cut off unused portions and concentrating heat or air in parts most desirable or necessary. It will thus be seen that *heating and ventilation is a complex problem of engineering*, but one capable of not only theoretical but practical

solution. But few persons seem to understand exactly how the air in a room is warmed. It is generally thought that the air in immediate contact with the burning fuel is warmed and that this air warms more air and so on until all the air in the room is warmed. *This is not so.*

There are but two methods by which heat is given out from any object: *Radiation* and *Conduction.*

RADIATED HEAT is that which leaves any heated surface at an immense velocity, travels in right lines, does not perceptibly warm the air through which it passes; will pass through a vacuum or various objects with equal facility and only warm objects on which it impinges and which intercept it. The objects absorbing the radiant heat rapidly. The *intensity* of the radiant heat depends on the temperature of the body giving it off. In the case of an open fire the rays of heat dart through the air — without heating it — in straight lines until some object is reached; *this object will absorb the heat and give it out to the air.*

CONDUCTION is that property which conveys heat from one part of a body to another, and varies in different materials according to their density. Liquids and gases are not conductors in themselves and can only become warmed by actual contact with heated surfaces.

The particles of any bodies in motion, especially liquid or gaseous, come in rubbing contact with stationary objects. When these objects are hot, the particles become warm; by some process they pick up the heat and carry it along. This process is called *convection;* therefore it will be seen that the process of heating the air of a room can only be accomplished by the particles of air coming into direct contact with a heated surface which may or may not be located in the room; may be taken from the apparatus of generation, from a reservoir to which it has been conveyed or from some object which has become heated by radiant heat. In this way all *radiated* heat can be used if proper means are provided for *converting* it. Water is heated on the same principle, each particle coming in contact with the heated surface in turn by circulation until all is uniformly heated. *Circulation and diffusion* of the air distributes the heat, but motion and agitation are necessary or the warmer air will rise and stratify.

The proportion of radiated and conducted or convected heat emitted, varies according to the temperature of the body, thus with a temperature of 100 degrees in excess of the air, the units of radiated and convected heat per square foot of surface of gener-

ator are practically equal, while with an excess of 300 degrees the ratio will be 68 radiated to 57 convected, the ratio increasing as the temperature rises. A red hot furnace will have an excess of temperature of fully 1000 degrees, in which event the heat will *nearly all be radiated*, which in this form will not affect the air and must be converted into convected before of any use. *In the average furnace no provision is made for this except as the result of accident or unintentional construction.* This will explain why furnaces do not give proportionate results, when raised to a high temperature. But *few heating engineers take these points into consideration.*

All bodies radiate heat and by a natural law known as the law of exchanges, the process goes on until all bodies are of the same temperature. The capacity of any body to absorb and again diffuse heat is of value in the construction of any heating apparatus, and is known as *specific heat.* This varies greatly in different materials, thus one unit of heat will raise the temperature of one pound of water one degree, while it will raise the temperature of one pound of iron eight degrees. *Specific* and *Latent heat* and the *conductivity* of *materials* are properties to be considered in constructing buildings, to prevent the escape of heat, its rapid diffusion and equalizing and maintaining the desired temperature.

Air is a mechanical mixture of Nitrogen, Oxygen and a small portion of Carbonic acid gas with a trace of watery vapor and an active form of Oxygen termed Ozone. The principal bulk is nitrogen; this is inert, its principal use being to dilute the vital and active oxygen. Oxygen exists in the atmosphere in a free state mixed with about four parts of nitrogen, is essential for the support of combustion as well as of life. The processes are similar, in both cases the oxygen being derived from the air, carbon and other impurities are oxydized and the products ejected; in both instances heat is a result.

Carbonic Acid or Carbon Dioxide is one of the products or results of combustion or respiration. In its pure state it is so dense it can be poured from one vessel to another like water and is 52 per cent. heavier than air. The other impurities ejected or emanated are to a certain extent combined with the carbon dioxide and its withdrawal takes along the other impurities. Gases without regard to density will in time mingle with each other forming perfectly uniform mixtures. This property is termed diffusion and insures the uniform purity of the atmosphere. As the process is slow, by properly located and arranged openings

we can withdraw these vitiated gases — before diffusion takes place — from the occupied apartments. The heavier gases, as in the case of denser liquids, fall to the bottom and should be taken from that location either by gravity or mechanical means. Owing to the greater gravity and density of these vitiated gases the common sense method of their disposal would seem to be to withdraw them downward and save the expensive operation of lifting them almost universally practised; especially would this be the case in Summer ventilation.

Air at a temperature of 32 degrees Fahrenheit is capable of absorbing 2⅓ grains of water per cubic foot, while at 100 degrees will absorb 19 grains. This thirsty property is called *humidity* and has much to do with our comfort. When the air is saturated with moisture evaporation from the body cannot take place, and when the air is dry too rapid evaporation takes place, for physical comfort. When we heat air from 32 degrees to 100 degrees it will expand 14 per cent.; if no moisture has been added this expanded air will contain about 2 grains of moisture per cubic foot while its capacity is 19 grains, *only containing a little over 10 per cent. of its capacity for moisture.* The proper degree of humidity for comfort is from 50 to 70 per cent.; this will explain the extreme dryness of furnace heat where air is heated to a much higher temperature than by steam. For comfort the air should be Laundried, that is the proper degree of humidity should be secured either by adding or extracting moisture, and in localities where air is not sufficiently pure or clean it should be filtered or purified.

Authorities differ as to the amount of fresh air required per capita. An adult requires about 20 cubic inches for each respiration, with from 16 to 24 respirations per minute, therefore from 320 to 480 cubic inches of air are required per minute. Air ejected from the lungs contains about 100 times as much Carbonic Acid Gas as the normal condition. The normal condition is about 4 parts in 10,000: any proportion up to 8 parts in 10,000 would be considered pure. As about ¼ of a cubic foot of air is required per capita for the respiration per minute, it will be necessary to dilute this with at least 25 cubic feet to reduce the percentage of Carbon Dioxide to the maximum proportion. This gives us approximately 30 cubic feet of air per minute per capita to maintain what is considered the standard requirement of purity. In churches which are only occupied for a short time at a session, and which are lofty rooms and contain air enough to dilute or neutralize the vitiating influences for the time occupied, the ordi-

nary practice has been one-half of this rate or 15 cubic feet per capita per minute, sometimes indicated as so many changes per hour which is not a safe rule however as it has no reference to the number of occupants which should be the factor.

There are two classes of fans used in the mechanical movement of air, volume fans and pressure fans, which are operated by Electric, Hydraulic, Gas or Gasoline and Steam Motors. When heating is done by steam, that is the most economical power, but as heat is not required during several months of the year, some other power is often desirable. Where an electric current can be obtained Electric motors are the most advisable, as they are always ready, easily managed and controlled, and can be located almost anywhere and operated under any condition. The Hydraulic Motor is the least expensive to install but most expensive to operate, while the reverse is the case with Gas or Gasoline. Some method is often employed of *cooling* the air during the hot months and for regulating the humidity. Some would naturally conclude that to heat such great volumes of air, approximating a volume equal to the entire contents of the building at least four times per hour, will be four times as expensive as to heat it once per hour; this is not the case. Air at this velocity is rarely passed into the room at a temperature higher than 90 degrees: Air will very readily absorb heat to this temperature, and owing to the velocity and volume comes in contact with objects to which this heat is quickly imparted, and the facts are that it costs but little if any more to *properly* and *continuously warm* a room, than to *heat* air to a high temperature, which with sluggish movement diffuses the heat slowly and irregularly. Wherever possible, practicable automatic controlling and regulating devices should be employed and all precautions taken for safety and security.

An *Ideal* apparatus would be *entirely automatic;* this would be possible with Electric heating, but until that system is made possible by reducing the cost it is entirely out of the question.

An Ideal system entirely possible and practical would be one with a continuous liquid or gaseous fuel supply, having all operations entirely controlled by automatic devices, which would include a temperature regulator; the only attention necessary being starting and stopping and care of a high grade to maintain the adjustment, *and will some day be realized.*

There are vitiating influences not heretofore referred to which must enter our calculations, the most prominent of which is artificial lighting. The consumption of one cubic foot of gas per minute vitiates as much air as one person, hence the ordinary

five foot burner must be calculated as the equivalent of five persons; these products are highly heated and should be drawn off above before cooling and falling to the floor.

There is also the generation of *Animal Heat* often sufficient in itself in a crowded room to maintain the temperature without any other supply after the apartment is once warmed. There are also many things which must be considered not herein referred to which are exposure, materials, glass-surface and climate, influence of prevailing winds, etc. The apparatus and system must be arranged to counteract or neutralize all these influences. Provision must be made for withdrawing the heated air always in the upper portions of the room, at certain seasons by ventilators in the ceiling, and controllable; this cannot be done by a small opening and air will not rush out as soon as they are opened neither will it pass out through openings at the base like water. The purest air exists at the higher altitudes, the towers should be utilized for securing it. Depending on open windows and doors is a delusion whereby the comfort of many is sacrificed for the benefit of a few.

We have thus briefly touched on the essential and salient features of this subject, which we may almost say is the vis viva of any modern perfectly appointed building and without which no successful sanitary arrangements are possible, the acoustic properties being alike dependent on its working, all should be studied, considered and employed in connection and combination to secure perfect results and always adapted to each particular case.

Section 2.—SANITARY.

Sanitation is an application of the laws of physiology and hygiene to the maintenance of the health and life of communities by means of those agencies which are in common and constant use; and as a special science has only been recognized of vital importance within the past half century. The true starting point of modern sanitary science dates back about 50 years, when for the first time was there any determinate method or approach to scientific exactness. Sanitary Science is really a study of cause and effect, and as far as the causes are preventable or removable the effects are removed or neutralized. In as far as we neglect the application of this science in its latest development, we are criminally negligent in a moral if not a legal sense; recognized of such vital interest it becomes a fit subject for compulsory legislation.

The Mosaic Code of Laws, the most ancient on record, contains minute directions for cleanliness, purification, diet and various other points bearing on the physical well being of the Jewish Nation. The Laws of Lycurgus are not wanting in stringent enactments on sanitary matters. The remains of aqueducts and sewers in ancient Rome, many of which are still in use, attest that this Imperial City was abundantly and munificently supplied with all then known sanitary requisites.

With the spread of Christianity a vital misconception of doctrine led to the establishment of orders or societies to feed the hungry, clothe the naked and institute hospitals to care for or alleviate the sufferings of diseased humanity. Considering an epidemic or unaccountable sickness as a manifestation of God's special anger that should not be interfered with, and would not see in it the natural result of a prolonged disregard of the laws of nature. When we consider the disregard to personal cleanliness, the insufficient and unwholesome water, absence of drainage, accumulation of filth, bad ventilation, the limited diet and the imperfect means for its preservation and preparation which existed, we wonder that the human race was not swept from the face of the earth by pestilence, or that any survived not enfeebled by disease.

The essential sanitary agents are Air, Water, Soil, Climate, Food, Clothing, Exercise, Construction of Buildings, Sewerage and Drainage. Air is rapidly contaminated by combustion and artificial lights, except electric. The impurities of air consist of suspended matters, gaseous substances and special impurities; among the first are germs of organic beings both animal and vegetable. The air is also seriously contaminated by minute particles resulting from the various works of man, such as soot, smoke, starch-cells, cotton fibres, particles of wood, stone, iron, etc., which inhaled irritate and cause diseases; specific poisons or germs of disease pass into and are conveyed by the air. Among gaseous matters there are many which pass into the air from natural causes or from manufactories, such as various compounds of carbon, sulphur, chlorine, nitrogen, hydrogen, oxygen, phosphorous, etc., etc. Besides these there are noxious vapors from decomposing animal and vegetable matters, etc. Among special impurities are the organic vapors of respiration and perspiration, vegetable germs, and infusoria, sometimes to such a degree as to produce fermentation of the atmosphere, producing the peculiar foetid odor of warm, close rooms, also germs producing epidemic and contagious diseases.

The natural methods of purification are *diffusion*, *oxidation*, *winds*, *rain* and *electric* action. When specially impure, disinfectants and deodorants are employed. Ventilation must be depended on to maintain the purity of the atmosphere in buildings; by changing and diluting the air, the poison germs of some diseases are destroyed while others are spread. Every building for public assemblage should be thoroughly flushed with fresh air after occupation to insure the removal of all impurities, leaving the apartments filled with fresh pure air. The foetid smell of a room recently occupied and not flushed should be sufficient warning; the foul matter in suspension will if left be deposited on all objects as a sticky, gummy substance and when next occupied will not be taken up by the air but adhere to the clothing.

Water is required, for drinking, for cleansing, and for sewerage; the sources of water are rain, streams, springs and wells. Water is principally contaminated by organic matter derived from vegetable substances and matter of animal origin; the latter is the most dangerous principally originating in cesspools, and sewerage. Most water contains mineral matters in solution, some of which are highly beneficial, other injurious. The consequences of using contaminated water is almost certain to be injurious.

Certain conditions are essential to insure healthy habitations or buildings. The site should be dry and not malarious, with ample light. Ventilation should be ample; there should be a perfect and properly arranged system of sewerage removal, an ample supply of water and such construction that will insure perfect dryness of foundation, wall and roof.

Sewerage consists of some system for the removal of all filth as speedily as possible and its disposal in such a manner as to cease to be injurious to mankind. Nature's warning of the presence of something that may do us harm, is an unpleasant disagreeable odor. Deodorizing is *not* the proper remedy, that only neutralizes the *warning* and *does not remove the danger.* There are three general methods of removal or disposal of sewerage or refuse,— by water, burial in the earth and fire. Removal by water means a complete system of drains, and abundance of water supply. As the removal should be continuous and ample, the proper disposal of sewerage is equally important. The foetid matters generate foul gases in the pipes which must have free outlet at some locality where it will not be injurious, hence the entire sanitary system must be not only water but gas tight. Earth disposal can only be considered when no other system is possible and then on a limited scale as many bad results are liable

to follow. Cremation is the most effectual way of disposing of all wastes in a short time. If the burning is not complete however, foetid organic matters are given off which are conveyed by the air, are very unpleasant and often injurious.

Having thus considered the general principles of sanitation, practical application as regards churches should receive attention. We will assume that the sewerage and drainage system of the locality as well as the water supply is ample and proper. All waste and drainage pipes throughout the building, and beyond the walls, should be of iron, having all joints calked with oakum and lead and of the grade known as extra heavy. Each vertical line of soil or waste pipe should have a line of vent pipe for venting the traps of the various fixtures. All the vertical lines of soil, or waste and vent pipe should be carried through and at least 3 feet above the roof without offsets or reduction. All fixtures should be open, and metal parts finished in silver or nickel plate, with self closing faucets, porcelain basins, marble slabs, etc. Every fixture should be trapped and every trap connected with the vent pipe by means of a branch pipe taken from the crown of the trap to prevent siphonage.

Vent pipes should as nearly as possible be vertical; the entire system of piping should be tested by filling with water, or air pressure before attaching any fixtures. Closets should be securely connected and should be flushed from cisterns capable of holding from three to four gallons of water with from 8 to 10 feet fall, and supplied with a flush pipe not less than 1¼ inch in diameter. Proper provision should be made for drawing off water from all pipes and other precautions against freezing. All connections with vertical and horizontal pipes should be made through Y branches and not by T openings. When the rain leaders are connected they should be trapped at their base or prior to connection with drainage pipes. There should be a running trap at the connection of the drainage and waste with the sewer, and a 4 inch fresh air inlet pipe leading to the outer air on the *building side* of this running trap. No section of piping should be without free opening to the air through the vertical vent pipes. These should not discharge near any window or chimney as the gases may find entrances to apartments by this means. Attention is essential to preserve cleanliness, as any carelessness soon becomes a source of danger. All rooms in which closets are located should communicate with open air and be properly vented. All woodwork should be simple and plain, and plastering when used thoroughly painted. Floors and wood-

work of walls should be coated with some wood preservative that will admit of frequent cleansing without injury, where possible floors, walls and ceilings should be faced with tile.

Recognizing the influence of imperfect sanitary arrangements on the health of community, the same are regulated in nearly all instances by State or municipal legislation, mostly under the control of a Board of Health. The governing rules prescribe the manner in which the work is to be done subject to inspection, and the owner is required by law to conform under penalty.

At first sight the prominence given to this work in a building suggests an inquiry as to the "reason why." This is easily explained. The purpose to be effected is the safe removal of the sewerage and waste matters, the introduction of a proper water supply and the exclusion from the building of sewer gas, laden as it is with the germs of disease. The channels for the accomplishment of these objects are in a great measure inaccessible after the work of the mechanics is finished. No code of rules can be laid down adapted to all sections of the Country. The architect in planning and specifying for any building should be familiar with the laws, rules or customs of the various localities and conform thereto. The character and pressure of the water supply must be considered, and piping of proper strength specified in accordance. There are many special traps and fixtures some of which are very good but for some reason not allowed by the regulations. In the event of wishing to use something not recognized, a special permit must be obtained; also in the event of making any change.

In addition to the cast iron waste pipes with calked joints, there is a system deserving of more than passing notice, in which all fittings are special. All joints are screw joints and the pipes largely wrought iron instead of cast for all pipes not buried in the ground. The special fittings are so constructed that there are no interior depressions. When screwed together the whole forms one continuous rigid system. It has been repeatedly asserted that wrought iron rusts more quickly than cast iron if unprotected; this is true, but most pipes are thoroughly protected by special coating. It is a fact however that all soil and waste pipes are soon coated with a peculiar greasy slime which tends to protect the pipes, either cast or wrought iron against corrosion.

When the plumbing and sanitary arrangements of buildings are regulated by law, compliance is essential. Where not so regulated more care is essential, and matter of introduction and arrangement should be entrusted to a competent experienced

architect or a special sanitary engineer, and only such fixtures and appliances used as are commended as being among the best. The various traps, connections, fixtures, etc., specified should be insisted on and not permit the substitution of some other "just as good;" that is no reason for change. There is evidently some other and deeper one not entirely unselfish.

Section 3.—ELECTRICAL.

Some one has said that civilization is a device of the devil for increasing our wants instead of supplying them. Certain it is that the wants of yesterday are the necessities of to-day and nowhere has this been made more manifest than in the conveniences that have been provided by the advances in Electrical Science during the past two decades. But if the advance in science has done naught but to stimulate our desires, it has fallen far short of its province, nor will our experience bear out such statement. There is an old saying that there is an innate tendency in the human make up to revert back to the savage state, but who that has once availed himself of the facilities of the telegraph or telephone by which distance is annihilated would now magnify those distances by the methods of long ago? Who that has enjoyed the humane and rapid methods of urban electric transit would willingly return to the plodding horse-car or mule? Who that has accustomed himself to the brilliant and healthful illumination by the electric light would exchange them for the tallow dip or rush light of our fathers? All of these things have now become a part of our civilization. To a certain extent however these benefits and luxuries are only available to those located in communities of sufficient size to make the distribution of electric current profitable to companies organized for the purpose. To many it is still considered a luxury, but to those who anticipate the future and the improvements that are certain to come it is considered a necessity, and no building is now considered modern in its equipment that is not supplied throughout with the electric light or provision made for its installation. On careful investigation we learn what at first seems to be anomalous, viz.—that more light can be obtained by using gas in a gas engine, driving a dynamo and thus lighting by electricity, than can be obtained by burning the same gas direct in the best burners. Many will not accept this statement without corroborative proof, nevertheless the statement is true, even with present systems of electric lighting, and will be much more evident with the vast improve-

ments sure to come and which are even now in evidence. Leaving the first cost of installation out of the question, this makes possible the isolated or independent plant for each building. The electricity may be generated by any means for which power is available, such as steam, water, or in isolated localities where no supply of any kind can be obtained, the use of steam or gas is still available, as gas machines can be introduced to generate gas, or an oil caloric or gasoline engine can be installed.

In the installation of an isolated plant however, the investor should secure all parts of the plant from some party who would guarantee it *as a whole*, and not have one party install the engine, another the dynamo, and another the wiring and lamps, etc., in which ease the owner must assume all risks as to results. In considering electricity and electric engineering in connection with churches it must be considered in two capacities, for *light* and for *power*, obtaining the current from some central station, or generated by an independent plant.

Lighting as at present developed is accomplished by the arc and the incandescent lamp. Inasmuch as the use of the incandescent lamp is practically light without heat, and the hazard of friction matches, inflammable oils, contact of light giving flames with inflammable gases, dust, etc., are overcome or eliminated, the risk or fire hazard is or should be greatly reduced. There are nevertheless mysterious fires which for lack of any apparent cause are attributed to electricity, electric wires, poor insulation, etc. No sufficient proof has ever been given that such is the general cause, although it unquestionably is in some instances. Improvements of all kinds have kept pace with the demands, and there is but little doubt that with reasonable care of installation and properly designed apparatus, electricity can be made not only a convenient but a safe method of producing light and power wherever needed and can be used in many places where other forms would be unsafe, undesirable or impossible.

The greatest danger arises not from the lack of proper materials or efficient safety devices, but from the employment of unskilled and incompetent men. When the work of placing and arranging wires, switches, motors, lamps and the many other details of an electric light or power installation is done by competent men who have been properly taught, the risk will be largely eliminated, especially if the installation is thoroughly inspected and tested prior to use.

When it is realized that a circuit for this purpose cannot be safely put in any space which chance provides, and that as much energy can be conveyed through a copper wire the size of a pencil as through a large steel shaft, that good workmanship and proper safety devices are prime essentials; then the demand for good work will drive incompetent men from the field.

At the entrance of every building there should be an approved switch by which the current may be entirely cut off. All conductors must have an approved insulating covering, must be of the standard areas required for the maximum current, and must be thoroughly protected when passing through floors or through walls, partitions, timbers, etc. In places liable to dampness must be protected by water-proof, non-combustible insulating tubes and approved insulated bushings where *not* exposed to dampness. They must be kept free from contact with any gas, water or any other metallic pipe or conductors by a firmly fixed non-conductor. Must not approach any high potential conductor nearer than one foot, should pass *over* all other metallic pipes or bodies in damp places and separated by a positive air space.

Open wiring must be wholly supported on non-combustible insulators, and the covering of the wire should not come in contact with any other substance. Wires of opposite polarity, with a difference of 150 volts or less, must be separated at least 2½ inches, the distance increased with higher voltages unless incased in moulding or conduit. Wires should never be laid in plaster or cement of any kind, and never fastened with staples; extra care must be taken in attics, lofts, floor or partition spaces, or any concealed space; twin wires should never be used for such locations. Moulding must never be used in concealed work or damp places, should be coated with paint or moisture repellent and made of two pieces, back and capping to thoroughly encase the wire, maintaining a distance of one half an inch between the wires of opposite polarity and protected from abrasion.

In better classes of installation, a tube or conduit is used to facilitate the insertion or extraction of conductors and to protect them from mechanical injury and as far as possible from moisture, and are to be considered as conduits or raceways only, and not relied on for insulation.

All conduits must be continuous from one junction to another or to fixtures and must be of material that will resist the fusion of the wires without igniting and must not destroy the insulation of the conductor;—Conduits should first be installed

as a complete system, as if for the distribution of gas or water. After installation and inspection, the conductors should be pushed or fished in, the conductors should not be placed until after all mechanical work of the building is as far as possible complete, if injured in any way must be repaired, must have all ends closed at junction boxes or elsewhere whether exposed or concealed, and all joints made air and moisture proof, and must extend at least one inch beyond the finished surfaces of walls and ceilings until dry.

Double-pole safety cut-outs, must be provided and placed in plain sight where readily accessible. These cut-outs must be supported on a non-combustible insulated moisture-proof base, and must be placed wherever a change is made in size of wire unless protected by a cut-out on a larger wire, and must be provided with fusible strip or wire properly enclosed and protected so that no arc can be maintained across terminals by fusing the metal; only in exceptional cases should any group of lamps requiring a current of six amperes or more be dependent on one cut-out, all cut-out blocks should be marked with their ampere capacity; proper safety fuses or other approved device should be provided for further protection.

All switches must be properly mounted on a non-combustible or moisture proof base, and must be double-pole, when the circuits they control supply more than six 16 C. P. lamps or equivalent; must be positive in action and of capacity to prevent heating; must be placed in accessible dry places grouped to control the lighting properly, and divided into systems; when jack-knife switches are used, they should be placed so as to open by gravity.

When using reduced currents, converters should *not* be placed inside of any building, or attached to outside walls unless completely insulated, and must be contained in non-combustible case.

All underground conductors when used should end outside of the walls of the building where possible, and should be removed at least two feet from and maintained free and clear from contact with any conducting material, should be thoroughly covered, protected, and provided with switch and fusible cut-out.

Electricity as power should be separately and securely conveyed to the location of motors which are used to operate the fans in moving air, or to blow the organ; all proper switches, cut-outs, safety-fuses, resistance-coils, etc., etc., necessary for protection and control must be provided; wherever possible currents for power should be obtained from a metallic circuit system of a low

voltage, and not from trolley wires or any system having a *ground return* or a *high tension current.* Should such be the only power available, all possible precautions should be taken, motor should be in an isolated building or completely insulated, and return current should not be discharged on any water or gas pipes direct.

In whatever light the question of wiring is considered, the natural conclusion is, that electric wiring of any building large or small, simple or complex, must be treated as time and experience have dictated for the distribution of gas or water.

In other words, concealed work must increase and ultimately become general; hence the prevailing methods must be improved on three lines; first,—as to finish, second,—as to permanence, and third,— as to reliability. The wires, joints and conductors may stand the initial tests of inspection and prove perfectly satisfactory for a time, but the electrician in charge must be continually on the qui vive to replace fuses, etc., caused by grounds and other detail troubles great and small, arising out of the manner in which installation is at present erected. Present methods of installation may be called a tree system with protecting fuses or cut-outs placed in all out-of-the-way locations and inaccessible places wherever it happens to be convenient to tap off branch leads; all fuse carriers should be placed in definite and convenient locations, and every method adopted for securing work, so finished and complete that almost any repairs can be made without damage to the building; the adoption of all the latest improvements will secure the greatest degree of permanence and reliability possible. Various applications of the Electric current save labor, give warnings and calls, automatically control mechanical appliances, etc., and to the extent possible and reliable should be employed. New mechanism of this kind is constantly being contrived, the modern inventor has combined electric nerves and muscles of brass and iron into something very like a conscious and responsive brain, culminating in his intelligence duplicating itself. Electric call-bells, individual telephone, electric gas lighting, control of heating and ventilating valves or apparatus, operation of doors and windows, annunciators, etc., as well as the automatic control of heat generation or supply by the thermostat are only a few of the possible uses of this new but now indispensable servant. While we do not know what electricity is, the governing laws have been largely ascertained, how to produce, control, and utilize it. Being a new material or force, certain new technical terms are used in its consideration and application, which should be briefly referred

to in this connection. There are three general methods of measuring electricity; the Volt, the Ampere and the Ohm: all of which can be best and most easily explained by comparison with water which is a visible fluid.

First, the *Volt* represents tension or pressure without reference to volume. Water being a fluid with weight occupies space and must have something to hold it, hence is conducted through pipes. Electricity has no weight therefore occupies no space and is conducted over wires; as water will leak through every hole in a pipe so will electricity leak from the wires unless perfectly insulated. As a certain amount of water measured in gallons will flow from a pipe of a certain size, in a given time and under a certain pressure, under like conditions will a certain amount of electricity pass over wires of a certain capacity, at certain pressures, in a given time: the volume of water is measured in gallons and is rated as so many gallons per minute. The volume of electricity is measured in *amperes*, and is rated as so many amperes per second, and what is pressure on the water in the pipes, in the case of electricity is called voltage or *volts*. As a pipe of a given capacity, at a fixed pressure will only allow a certain amount of water to pass per minute; so the wire of a given capacity, will only allow a certain quantity of electricity to pass in a second: this property of the wire or conductor is called its resistance, and the resistance is measured by the Ohm: the resistance is a fixed property, by increasing the pressure or the voltage we can overcome this resistance, and pass a greater volume of water in one instance or of current in the other. The result of resistance is heat, thus producing the electric light, or fusing the wire.

In a properly installed plant the electric current will subdivide and take as many paths as are offered, and the largest quantity will take the easiest path, consequently by offering resistance to its flow on a main line it will distribute over all branches; the great problem of electric engineering is to properly proportion the wires, both as to area and to length; make provision for the proper volume of current and maintain the proper tension by resistance, sometimes by the wires and lamps and sometimes by the insertion of an appliance called a resistance coil or rheostat. If resistance is met that can be overcome it is opposition, and the motion produced in overcoming opposition gives the power from which work is obtained. It would be well to remember, that while a current of low pressure will not seriously injure anyone, the better plan is not to touch any electric light or power wires.

Section 4.—CONSTRUCTIONAL.

Constructional engineering is that portion of architectural practice so often conspicuous by its absence, but of vital importance to the durability, stability and safety of any building. The unfortunate conditions existing, wherein a person is allowed to determine for himself whether he is an architect or not, with no license or examination as a safeguard for the protection of the public is largely to blame for much faulty work. After the execution of some commissions, the work will demonstrate his ability as a designer but not as a constructor. How often are even our best architects helped in constructive emergencies by a competent contractor who cannot afford to do otherwise; the building *must* stand until completion and settlement of accounts. The general public take no means of ascertaining whether the architect they employ has a knowledge of the principles of construction or not. But little if any investigation on this vital point is made; he calls himself an architect, shows fine pictures, talks technically and glibly about architecture, etc. He may have employed some draughtsman to make his drawings, read up on the subject in a general way, and with no more knowledge of construction than of theology and possibly not as much, is employed to design and plan the construction and direct operations, to judge of materials and processes of which he has no knowledge of even the elementary principles. He will not confess to this ignorance, depends on successfully carrying out the deceit until contracts are let, when the contractor's interest will be to help him out.

In the case of the physician, the attorney, the pharmacist, etc., certain qualifications are essential and must be demonstrated before an expert board of examiners; before they can practice a license is granted and if they are afterward found inefficent is revoked. Are not the construction and essentials of our buildings of sufficient and vital interest that the same safeguards should be thrown about them? Yet we are met with the argument in this case, "that it is an infringement of man's constitutional rights of freedom in his business pursuits." For this condition the public are largely to blame for employing men with no evidences of ability, and often determined between an amateur and a man of experience by a mere question of price, often so trivial when compared with the importance of the work that the neglect is little short of criminal and in case of fatal disaster would be so construed by the courts. The indifference to these responsibilities displayed by the average Committee makes them to a certain

extent parties to the fraud — if such it may be called — to which conditions their acts imply consent, as they endeavor to cover up from the appointing body, errors and mistakes of their agent or employe which should have been avoided by the exercise of better judgment and discretion in selection.

Constructional engineering is that department of Architecture which deals with questions of strength of parts, weight of materials, strains and ability to resist strains. It should be unnecessary to insist on the importance of statics, when the special branch of Architecture we are considering is conceded to be *especially a constructive art*, whose productions should without doubt or question stand securely and without extraneous help. The science of Statics is defined as " the effect of forces on solid bodies at rest," and a building should always be at rest.

The main forces that are brought to bear on any building is the gravity of the materials used in its construction, and these materials when in the form of inclined beams, as in roofs, or of the wedge shaped pieces of arches, vaults or domes, tend to overset the parts they abut against. There are also extraneous loads put into them which often have a thrust of their own in addition. The pressure of the wind, the vibration caused by it, and the weight of snow are external forces that act in the same way, and occasionally though rarely, the mechanical forces of water, ice and fire. Among the causes that produce effects in buildings, those of statics are much the most important and in many instances vital. It cannot be denied that raking shores when a roof is not tied are essentials, as also the system of shores which compose the buttress and flying buttress.

Although construction is the master art in building it rarely brings to the architect fame or reputation, and seldom recognition, and the old saying " to speak well of the bridge that carries us" is universally overlooked. So simple does this tremendous and important art seem to the ignorant, that but recently was a book published wherein the author endeavors to show that all the most convenient, elegant, and beautiful houses were designed by their owners. Such an example of sublime conceit, stands almost without parallel, and the publication of such an unsubstantiated statement is simply audacious in the face of the facts: Almost as well might spontaneous generation, or the fabled work of Genii be credited. Let the smallest defect be discovered in the construction, plan or design of a building,— to speak of nothing else,— the owner will be quickly awake to the fact that the building was *not* self-created; the responsibility for *faults* will be

quickly disowned and the true author as quickly made known, and woe betide the Architect who has committed so unpardonable a sin.

Every Architect cannot be a Wren, but everyone who asks employ of the public should know how to calculate the strength of a column, a girder and a truss, the conditions of stability of a steeple, and a wall against the wind, earth or water, the thrusts of an arch, a vault and a roof and the pressure of contained bodies of water; without this knowledge serious disaster may follow. Too much construction is solved by the rule of thumb which is dangerous practice, especially, as is almost always the case, the most must be obtained for the money, and all construction is designed and calculated dangerously near to the safety limit. A slight deviation may pass this limit which competent mathematical calculation should demonstrate and the result will be the fall of a wall or tower, or the failure of some vital part of the construction, often fatal in its results. Investigation fails to discover the fault after the disaster and thus the work goes on.

Without straining the truth it would be safe to make the statement that not one architect in ten in actual practice can personally and reliably perform all the calculations essential to the stability of a modern building of any magnitude and complex construction. Many of our most profound students live and work in the past, study nothing later than the thirteenth century, and are indignant when asked questions about so new fangled a material as iron.

Hitherto the general forms of supports have been walls, piers, and columns; covering spaces with vaults, and ceilings supported by beams and trusses. Walls could only be carried over spaces by means of the arch and long floor spans must have intermediate supports. Vitruvius lays down as a proposition that "symmetry arises from proportion and that proportion is a due adjustment of the size of the different parts to each other and to the whole." No building can be said to be well designed which lacks symmetry and proportion; hitherto proportion has been largely by rule determined by precedent, but modern buildings are for such varied and different uses, with new materials and construction, that the application of the principles as given by Vitruvius as far as the structural parts are concerned, gives entirely new proportions, and to adhere to the old proportions with our steel construction and methods would only waste space and material. The cast iron and built up steel column now supersedes the pier for all intermediate support. Floors may be

carried over great spans by beams and girders, walls of great domes and other construction may be safely carried over, hitherto impossible spans; spaces may be safely covered with roofs and ceilings of any desired form impossible by other methods. The more modern use of steel in construction has reduced the quantity of material to the minimum, and has rendered almost any imaginary or conceivable form of building construction possible. Exhaustive experiments have resulted in formula and tables from which the strength of every kind, character and form of material may be calculated and under every condition. For the safety and security of the public, certain general building laws are enacted, either municipal or State; which must be complied with but cannot protect in every detail, neither can the inspection necessary be given to secure positive. assurance of compliance. Personal attention of a competent, conscientious character is essential.

No more material in any part or portion should be used than necessary to secure the requisite strength and stability; economy demands this and its non-observance is a waste. The great modern constructions are striking evidences of faith in the strength of materials, in the various formula from which this strength is calculated and in the person who makes the calculations, indicates the material and construction and directs the operations. Who would risk the slender steel column or girder to carry the tremendous strains or weights imposed — which sometimes make one shudder to contemplate — in the light of any precedent? Properly protected against the action of the elements or time such construction should be as enduring as any works of man; disintegration and decay are laws of nature, and the gnawing of the tooth of time commences as soon as man creates. We can only delay it by the use of every precaution in our power.

The first uses of iron in construction made possible much which could not otherwise be accomplished. There was much improper and inconsistent in its first application, as in the introduction of any novel material or process, all of which has been eliminated and the methods reduced to a science. The recent discoveries of producing steel for nearly the price of iron,—and considering its greater strength more economical,— taken in connection with various methods of construction and preservation, makes its use an essential of modern construction. Cast iron is still largely used for columns and various fittings, and steel for forms or members requiring great tensional strength, steel or iron used in combination with other materials should be carefully

calculated and considered, as the expansion and contraction of metals subject to changes of temperature is much greater than any other material.

A combination of steel and concrete is largely used for foundations reducing the bulk and giving greater strength, besides combining the whole in an integral mass. Many methods of fire-proofing are in use and should to the extent possible be considered in connection with construction, as fire is one of the greatest destroying elements. It is now possible to construct first class buildings with such high fire resisting qualities, as to be considered fire-proof, with an advance of but 10 to 15 per cent. over ordinary methods of construction. A building may be constructed entirely of non-combustible materials, yet not be fire-proof as regards damages resulting from fire, as to a certain extent the furniture and contents of any building are largely inflammable, the heat which would be generated in the combustion of which might shatter the massive stone of construction or expand the iron or steel so as to result in destroying the structure. There are but few building stones which will withstand the action of great heat. Metal exposed to heat is seriously damaged or destroyed unless protected, wood is consumed, while clay products are uninjured by fire as they are of igneous production. The distinction should be made between non-combustible and fire proof construction, wherein all materials injured by exposure to intense heat are thoroughly protected; slow burning construction is sometimes safer than fire proof.

CHAPTER XI.

INHERENT ESSENTIALS.

ACOUSTICS, LIGHTING, CONVENIENCES, ETC.

Section 1.—ACOUSTICS.

" E that hath ears to hear, let him hear," we might add—if he can, as applied to many churches, which are but little more than resounding and reverberating caverns: some take refuge in an old proverb that "what can't be cured must be endured;" does honest investigation demonstrate that perfect acoustics is an unknown or uncertain quality? a child of chance? In the days of ignorance of the governing principles, when faults were winked at and the resounding echo or reverberation was considered almost a sacred essential to a house of worship, failure to secure what is now considered the most desirable property of an auditorium was not considered a serious fault, but now such a failure would be considered inexcusably stupid, not to say unchristian.

Prior to an analytic consideration of the subject a few words as to its importance will not be amiss.

There are styles of church architecture which can be commended for some denominations or forms of worship and not for others. A ritualistic church requires impressive, sombre, and stately buildings, but the church which depends largely upon its pulpit ought to be built with reference to that fact. This class of churches must be good to preach in or they are good for nothing. An eminent divine thus strongly puts it—"Acoustics is so important that I would place it before every other merit. Before light, or ventilation, or comfortable seats, or beauty, or any other virtue. Give us churches in which the human voice can be heard with pleasure and profit." No amount of tact or talent in the speaker, or of devotion and co-operation on the part

of the people, will make listening pleasant when the laws of sound are violated. Many a man is perplexed over his failure to win the people, and many a church astonished at the meagre returns that talent, unlimited expenditure, assiduous attention and prayerful devotion have brought, when the whole difficulty lies in the house. The house may be architecturally perfect, and a thing of beauty in every other respect, but so defective in acoustics that one is almost led to believe it was intentional; a speaker may in time get accustomed to his house, and by holding his voice to a certain pitch, or keeping his face in a certain direction, or some other device, manage to be heard. Successful oratory in such a case is out of the question. Churches should be built to help, and not hamper the speaker. Music Halls and Theatres are built so that the voice is at home in them, and the acoustical properties nearly perfect; all of which demonstrates that our churches *can be also*, if properly arranged. There is an oft repeated statement, that the acoustics of halls, theatres and churches are notoriously and confessedly *a matter of accident;* this statement is erroneous, there is no logic or truth in it.

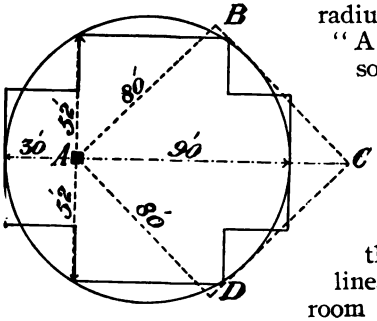
Acoustics in architecture is a subject concerning which authorities differ, to such an extent as to bewilder the student, the reason is this; authorities are in most instances theorists, not only in this but on most subjects, *practice often demonstrates the utter absurdity of even accepted theory.* In medicine, the first essential step is a correct diagnosis,— *bear this in mind*, as it is an essential in *all* investigation,— all theory should be based on it and it should be demonstrated by practice. Therefore, we must first study the human voice, the human ear, and the construction of musical instruments in harmony, ascertain the natural laws governing and work in accord. Experience has demonstrated that acoustic results depend as much on the knowledge of the various *materials* entering into the construction and finishing of an auditorium, as on the *proportions and contour* of same, in all cases, however in connection with a thorough knowledge of laws governing the *genesis*, *propagation*, *reflection* and *augmentation* of sound.

Sound, in its *genesis*, may be divided into three general classes: Speaking, and Vocal and Instrumental Music.

The *propagation* of sound is by multitudinous waves sent out in all directions from the genesis; these waves of sound have an undulatory or vibratory movement of periodic extent and amplitude, which is governed by the pitch or initial vibration of the tone or note creating its corresponding wave in the air, each tone or note has a different rate or period of vibration; for

instance, the French standard pitch C has 512 vibrations per second, which propagates a wave about 2⅔ feet in extent, as the sound wave is propagated by the air it follows that the air must be in proper condition; the velocity of sound depends on the elasticity or density of the medium; impurities increase the density and reduce the velocity; sound travels faster in warm air than in cold, and at a rate of 1130 feet per second in pure air at 70 degrees Fah'. Hence uniform temperature and purity of the air are the first essentials, the direction of currents if any, should be along with sound waves or the sound waves will be retarded, free space should be provided, obstructions such as massive columns, partitions or solid gallery fronts should be rigidly avoided if perfect results are desired; also *reflecting* surfaces, curves of angles or ceilings cannot be such as "*look well*," but must be determined by the height of ceiling and distance from the phonic centre, faulty lines shapes or curves may *aggravate* reflection instead of preventing it, and result in concentrating reflected waves in certain parts of the house. Echo is due to reflection and to the *intensifying* quality of the material of the reflecting surface. Injudiciously placed hard or smooth surfaces reflect more, and with greater force than rougher soft ones. Reflection is more powerful within certain limits, in an auditorium of small size, say, 60 ft. there will be a preponderance of sound over one of 120 ft.; if is therefore necessary to construct the smaller one differently, to *reduce* the resonance, which in the larger must be *augmented;* for an auditorium of extraordinary size powerful resonators may be necessary.

The governing principles may be briefly stated as follows: — Inscribe an area with a circle of 60 feet radius — then place the phonic centre "A" 30 feet within the periphery, sound will be heard with equal force at all points of the periphery, that is to say 90 feet in front, 52 ft. either side and 30 feet to the rear. The cut indicates the application of this principle to the cruciform church, as well as the diagonal; as shown by dotted lines "A" "B" "C" "D" for a room 80 feet square.



It should be noted, *that an auditorium that is practically all that could be desired for speaking, is not always acoustically satis-*

factory for music, while one that is satisfactory for music is nearly always good for speaking, hence the *musical* requirements should be considered, in arranging the church. Any one will bear witness to the fact, that in some halls or auditoriums they can enjoy music much better than in others, although the proportions appear the same, and the acoustics equally perfect. The reason of this is, that in the one instance the music lover is *physically in vibratory sympathy with the rendering*, and the *key* of the room is in harmony, while in the other case there is a discord. As each note has a different period of vibration which is of different length, the shape and proportions of the auditorium should be a multiple of the unit of vibration, which will then produce the last vibration in full, and the *key* of the room should be a natural key. Should the proportions not be proper, the last wave, not being full will cause a discord which will be reflected to meet the next wave, or the one will neutralize the other and will result in *deaf* spots; as the length of sound waves vary with each note, these deaf spots will *vary with different tones.*

One vexing condition has been settled by the use of the incandescent electric light, thus avoiding the stratification of the atmosphere heated by the lamps or gas. With a room in which the cubic space exceeds 300 ft. per capita, too great resonance need not be feared; and if the room is large every means of increasing it must be employed. As the proportion decreases the resonant surfaces must be replaced by those of less resonance, until the conditions demand hard, smooth, non-resonant surfaces. With a minimum of 150 cubic ft. per capita, curtains are sometimes necessary in smaller rooms, made of sound-absorbant material to *reduce* resonance, this is a delicate matter,—to properly place, the proper amount of proper material, without *muffling* the sound: there is also difficulty in adjusting an auditorium so that the same result will prevail with a large as with a small audience, or a well filled house versus empty seats.

It is impossible to lay down any rules as to proportion, size or materials to be used in securing a perfect auditorium; in some instances the hardest reflecting surface may be necessary, such as smooth hard cement plaster, in others rough, soft, porous plaster. The steel ceiling may be an essential, or a serious damage, it may want space back of it, or require felt deafening, in some instances it may be necessary to construct ceilings and walls in panels of wood, those most remote being thinner and of the more easily *excited surfaces.* In a large room surmounted by a dome it may be necessary to maintain an artificial stratification of the air

or an *air ceiling*. The shape of the ceiling or rear wall may be such as to reflect the sound direct back to the phonic centre, this is a most disastrous fault making speaking very difficult, the words coming from the speaker's mouth meeting the reflection of preceding words, making it almost impossible to utter them.

In a large and misproportioned auditorium remedial measures such as sounding boards, stretching of wires or heavy curtains may be warranted. These only tend to neutralize bad results and do not remedy defects, no rule can be given for the location number or tension of the wires, this can only be determined by experiment.

Hence, *no set of rules can be laid down which will assure perfect results at the hands of an amateur*. Perfect acoustics may be the result of accident, the successful practitioner should demonstrate by *numerous* and *varied successful* applications that it is *not accident*, but a *consequent* result.

In practice, one may be called on to produce some special form or character of Auditorium: say the cruciform, with large and lofty dome over the intersection; a form *notorious in nearly all its existing examples for poor acoustic properties*, sometimes so bad as to render the room almost valueless for the purpose, the great problem is to secure perfect results in the face of almost total failure in all existing examples. A knowledge of the laws governing the production, and propagation of sound; the intensity, amplitude, reflection, refraction, diffraction, resonance, temperature, air-movement, condensation, and rarefaction, enables us to secure perfect acoustical results in a room of almost any form, without additional expense if combined with construction, but *if not inherent is practically beyond remedy*. Thus two buildings may be erected practically the same, the one a success because of perfect inherent properties, and the other a total failure, numerous instances of this character are in existence. No man can sit in his study and formulate a theory which will assure positive results. In every profession and business, experience is essential, and experience is only gained by repeated and sometimes disastrous experiment. A theory which is based on a long line of successful experiments, as the result of extensive practice, gives all the assurance possible that it is not merely theory but *established principles* that govern, and that like causes will always produce the same results. Notice in Chapter XII under "Choir and Choir Seats" further consideration of this subject in that relation.

Section 2.—LIGHT; NATURAL AND ARTIFICIAL.

"Hail Holy Light! offspring of Heaven, first born;
Bright effluence of bright essence increate."
Milton, P. L. III—1.

Light is that form of energy which acting on the organs of sight renders visible the objects from which it proceeds or is reflected, and is itself invisible. There are but two kinds of light, *Natural*—that proceeding from the Sun and Stars—and *Artificial*—from heated bodies, electricity, etc. Light is not and must not be considered a substance. According to the most universally accepted theory, light is caused by the extremely rapid motion of the molecules of the luminous body, which vibrations are taken up by the ether and propogated in right lines, passing directly through certain substances called transparent. Some substances totally obstruct light, others partially, this property is termed degrees of opacity. Some surfaces reflect and others absorb light in various degrees. For the most satisfactory results in lighting interiors these various properties must be considered, as perfect *diffusion* of light is essential to any well lighted apartment.

Natural lighting is secured by two methods, windows and skylights, and artificial by various systems and methods of illumination. For the purpose of determining the amount of light and for comparison, some standard of intensity must be adopted. The light produced by a sperm candle known as "short six" and which consumes 120 grains per hour, is accepted and considered as the standard, and is in all comparisons called 1 candle power or C. P. The intensity of sunlight at the surface of the earth has been estimated as equivalent to about 5500 C. P. at a distance of one foot, (light decreases with the square of the distance.)

No general rule can be laid down for the proportion of windows or the amount of glass surface required for any given apartment, all of which must be determined by the climate, the temperature, length of days, general clearness of sky, customs and requirements of the people or the service. In order to obtain the best results, light should be obtained from as many openings as circumstances or design will permit, and should be taken from two or more sides rather than one, which will neutralize shadows and diffuse the light to the best advantage.

The proportions of the room as well as the location of the windows must be considered, as the intensity of light ra[illegible]

creases with distance, and to diffuse the light in a room equally will require in some portions reflecting surfaces and colors, and in others absorbents, the remote parts should be sufficiently lighted for all purposes. Therefore, while the safe rule would seem to be based on the cubic contents of the room, and that there should be some direct ratio between the aperture admitting light and the amount of space, the distance, direct or reflected must be considered, as well as the height of room and openings; as it is evident that with an apartment 100 ft. by 40 ft. and 30 ft. high, the same openings distributed on either end will light more perfectly than on the sides, while in an apartment of the same size and half the height, windows of one-half the opening will not distribute light to the centre with any satisfactory results.

Therefore, the general rule,—"*add together the height and depth of a room, 1-8 of the sum will give the aggregate width of opening required, and the square root of the product of the length, height, and width will give the area*" — will only apply under certain conditions. A foggy, cold, damp climate will require much more window opening than a clear, warm and dry climate, likewise one in which the light must be taken from a nearly horizontal direction will require much more opening than one which obtains its light from near the Zenith. Rules are generally given for *clear* glass, and the area should be the actual *daylight* opening or *glass area.* Light will pass directly through clear glass, some *surfaces will refract,* and while allowing nearly the whole amount to pass will diffuse it more generally. Nearly all glass used for churches is stained or colored which with the various qualities renders it more or less opaque. This is a factor to consider, as upon the quality or character of the glass the elements of construction, as well as other conditions in and out of the room, depends the degree and success of natural lighting.

There is no standard of light intensity; for day service, with cloudy weather, the room should not be gloomy, it should be possible to read with ease in all parts, the character and quality of the glass should be such that with brilliant sunshine the *light would be diffused* and not produce unpleasantly lighted or brilliantly colored localities, although the surface of the glass itself may be disagreeably light. This cannot be avoided if sufficient transparency is preserved for the most unfavorable conditions; the orientation of the building should be such that windows that face the auditors or speaker will not be thus unpleasantly lighted during the hours of service. When this is unavoidable, curtains or awnings should be provided to counteract the ex-

tremes of light, as it is impossible to provide or arrange windows of such area or character of glass as to secure perfect or satisfactory results under all conditions. Windows should be arranged both with reference to exterior design and interior requirements; while the vertical windows of the exterior, or the clerestory are generally considered the proper methods for obtaining light, conditions may prevail,— such as a city church on an interior lot,— where this is impossible and where the skylight is necessary for the whole or a part of the building.

It is a matter of experience that the greatest quantity of light is obtained for an apartment when lighted by a horizontal aperture in the ceiling. When the skylight is necessary a glass which will diffuse the light should be used. The best method is by arranging an exterior and interior skylight, the space between well ventilated and provided with controlling curtains, the exterior glass a heavy roughened or ribbed glass, the interior stained, avoiding unpleasant colors. In all cases the angle of incidence and reflection should be carefully studied, as well as the character of glass and the colors used for decoration.

All principles governing lighting by natural sources will prevail in the case of *Artificial lighting*. More latitude however is possible in the arrangement of lights which may be distributed or concentrated; reflectors may be used to advantage and various decorative effects produced.

The most general method of artificial lighting is by gas, although the electric light is rapidly being introduced, and where possible to be utilized or secured, to be preferred, as the air is very rapidly contaminated by the numerous gas burners in addition to the heat generated which is often quite unpleasant. With the incandescent electric light there is no contamination of the air and no perceptible heat. The light produced by the incandescent electric light is much more pleasant to the eye than any other; the arc light should only be used for large halls or exterior lighting. In using glass globes the loss incident should be considered, which ranges from 12 per cent. for clear glass to 40 per cent. or more for ground glass.

Section 3.— CONVENIENCES.

Closely allied to the inherent essentials of a perfect house, are conveniences which should be so incorporated into the construction, as to practically form a part of the structure itself, not the bone and sinew but the nerve so to speak.

The house as constructed has been endowed with a certain amount of innate intelligence, enjoys pure air, breathes,—mechanically to be sure, nevertheless breathes:—a comfortable temperature is maintained, contamination is avoided by sanitary arrangements, enjoys the light and sunshine, darkness is dispelled and esthetic, artistic taste prevails. All these may be inherent properties or automatic mechanical operations, nevertheless must be controlled by some supervising influence or intelligence and a system of nerves provided for conveying the wishes of the directing intelligence to the different localities of operation. For this purpose a maze of wires are concealed within the walls and floors. At the entrance door of the modern church we are met with a plate containing a row of push buttons and terminals of speaking tubes indexed; a touch to one will sound a call in some remote part of the house calling the person in charge to the door, another will announce a call to the pastor in his study, communication can be held with the sexton or pastor through the speaking tubes, the door may be unlocked by the pastor or sexton by touching a push button in remote parts without going to the door; similar connections can be made with a church office if one is provided. From the study, speaking tubes and call bells connect with various portions of the building. A switch should disconnect all exterior bells during services.

In a perfectly appointed plant, all operations of valves and deflectors of the Heating and Ventilating and Lighting systems should be controlled from some central location. In some inconspicuous place, convenient to the pulpit or superintendent a row of push buttons should connect with an annunciator indicating to the sexton or other attendant the desired changes, a few of which might be "More Air," "Less Air," "More Heat," "Less Heat," "More Light," "Less Light," "Side Lights," "Chandeliers," "Reflectors," etc., etc. A system of signals from pulpit to choir is of advantage, also from study or vestibule to choir, so that if desired the exercises may be properly timed. The organist or chorister should have signals to the choir or ante room to time the entry of choir, and for a large chorus choir proper signals should be provided. All calls during service should be by a buzzer and not by call bell; there should also be communicating signals from pulpit to ushers. From the superintendent's platform in the Sunday School should extend wires to call bells in each class room, thus by a system of bells, calls, signals and speaking tubes the various exercises can be perfectly managed avoiding confusion.

In lighting by gas—either general supply or machine gas—the fixtures should be arranged in systems, and all inaccessible fixtures lighted by electric gas-lighting apparatus; the gas and electric lights should all be controlled and lighted from a central location, and when not occupied the supply should be entirely cut off from building.

Water should be distributed to all fixtures and proper safeguards provided against damage. Drinking fountains at convenient locations are desirable. A large fountain with plants, etc., is an attractive and cheerful feature in the rotunda of a Sunday School Auditorium. Large Baptistries are essential in many churches and where introduced should be essentially a part of the church with proper arrangements for filling, drainage, overflow, and quickly raising the temperature of the water. The Baptistry may be in the usual form of a tank or pool, or may be combined with scenic effects to represent running water; the approach should be convenient, out of sight, properly connect with robing rooms and may be located in the Auditorium or Lecture Room.

Details of arrangement of Chancel, Pulpit, Choir, Organ, Altar, Furniture, etc., differ with the different denominations, also in churches for the same denomination, each making such arrangements as are considered best adapted to each individual case, perfect adaptability in each instance being the only test of orthodoxy. In many churches special seats are provided to accommodate the aged or infirm, in some instances protecting them from any draughts or currents which might be unpleasant to the debilitated, with special arrangements for warming, and sometimes with concealed tubes connecting with a receiver or megaphone located on the pulpit in front of speaker, and by elastic tubes with the ears of those whose hearing has failed, enabling them to sit and hear in comfort without becoming conspicuous. Every convenience should be employed that will minister to the comfort which ingenuity can contrive, only a few of which have been suggested, leaving necessity, desire or imagination to swell the list.

CHAPTER XII.

FURNISHING.

SEATING, FURNITURE, CUSHIONS, CARPETS AND SPECIALTIES.

HE method of seating a church is a question which each society must settle for itself, and is largely one of sentiment, opinion or custom. Whether the floor is level, bowled or inclined, the pulpit at the side, end or corner will be factors in determining the character and arrangement of the seats.

With the shortening of the hours of service has been an increasing sentiment for ministering to the bodily and physical comfort; the rectangular plan and straight back, bare-bench seating has gone with the other penitential methods of service. The MODERN PEW is now designed to perfectly fit the curve of the back; the inclination and height of the seat as well as the height of back are carefully considered so as to secure the greatest comfort to the occupant. If arranged on the amphitheatrical plan, the seats are built to concentric segments of circles, or arranged on chord lines, with elegantly designed ends, and divisions, sub-dividing the pews in proper lengths.

The method of constructing curved pews should be such that they will retain the proper curve, the backs should be laminated and each built to its true curve, otherwise they will not be parallel; the ends should be heavy and routed out for the reception of seat, back, apron and roll, all secret nailed and not secured by resting on cleats, with a sufficient amount of intermediate supports to secure rigidity and strength, provided with book racks equivalent to 10 inches to each sitting properly distributed. The design and material should conform to the general style and finish of the building.

Sometimes there is a preference for individual seating, when a seat similar to an opera chair is used, the seat and back fold

noiselessly into a vertical position when not occupied, which is a convenience both for sweeping and passage. With one style of this form of seating — known as auditorium seating — the back is continuous and rigid with the individual curve to each sitting and individual folding seats, omitting all intermediate arms except such as would correspond with pew divisions. Another form, known as divan seating, combines three, four or five individual seats in one, back and seat folding. All are furnished in plain wood, perforated seat and back, or upholstered to any degree. There are advantages and disadvantages to either style of seating. The pew is favored by many on account of association, and in that it preserves the family relations, while by others the chair is preferred as being more comfortable, agreeable and individualizing the congregation, the auditorium and divan seating being compromises. Galleries are constructed in terraces and seated similar to the main floors.

In the early churches of the colonies people of consequence sat in family pews or seats, which were often considered private property, descending from father to son as an appurtenance to and sold with the residence; this property right is to the present day recognized among some of the older churches.

Occasionally a gallery was introduced which was but little else than the cutting away of the central portion of the second floor of a two story house, the speaker being so located with reference to height, that he could speak to the audience on both floors at the same time: Many churches exist to the present day of which this was a type. In many churches the gallery was the place of dignity and leading families were very jealous of their rights of property therein.

At that time the house of worship was the proper place to air one's superiority, and families were pigeon-holed according to their relative rank; it was accounted improper to permit the tw-

sexes to occupy the same seat, or even sit on the same side of the house, hence in such cases there could be no family pew. In some instances everyone was assigned his proper position in the church by act of legislature, according to his official dignity or the amount of money he had given and in some cases adjusted by the tax book; likewise were seats set apart for the church dignitaries according to rank. Square family pews, or rather pits, were in general use early in the 18th Century and were about 5 feet deep with seats on two and often three sides often folding on account of the narrowness. When seated, occupants of the different pews could not see each other or anyone coming or going. Later, spindle tops were introduced, when occupants of neighboring pews could see and converse with one another.

For awing into decent behavior, the inconsiderate youth and the disorderly, the tithing man or an equivalent official was placed in charge who sometimes went about with a long wand with a ball at one end and a fox tail at the other, who would tap a man or boy who should be overcome with sleep, or brush the faces of the women caught dozing. In churches of this character the galleries were generally unseated, and the pestiferous boys were sent there with men specially appointed to watch them and keep them in order. As services sometimes continued for a space of three to five hours and even more, the arduous duties of the tithing man can best be imagined. Collections were sometimes taken by a box or bag suspended on the end of the rod or wand and dipped into these pews by the tithing men, and sometimes by the entire congregation passing two abreast in the order of dignity up one aisle, past the deacon's seat and putting the offering into a wooden box and then passing down the opposite aisle.

The early churches and cathedrals were not seated, the original meaning of pew being "*anything on which to lean.*" The first seats were plain benches, all facing East, — as all churches and cathedrals were erected with due consideration to their orientation — and up to a period sometime after the reformation were confined to the nave. The seats were from two and one-half to three feet high, and later partially enclosed with partitions of wainscoting. After the reformation and principally under its influence, they grew into large and high enclosures containing 2 to 4 seats lined with baize, fitted with desks, doors, etc.

In the earlier churches, ceremonies and rites formed a large part of the service, sight was appealed to rather than hearing, in consequence were constructed of immense size. In the churches

of this country the great controlling principle is their adaptation to comfortably hearing and seeing the preacher. With consideration of the church more for hearing, acoustical properties are essential, hence in seating, these properties must receive due consideration; therefore wherever possible, seats should be arranged on the lines of the izacoustic curve, in connection with which the proper location and elevation of the pulpit are essential, hence the lines of seating must be considered in section as well as plan. In lecture rooms, benches, chairs and settees are often used.

Various kinds and characters of seating are provided and procurable for the various accessories, such as the Sunday School, Lecture room, league, society and class rooms. For the class rooms of the Sunday School, independent chairs or settees are the best; each class provided with a special teacher's table, arranged to occupy as little space as possible and contain the books and papers of the class, in the central portion of the Sunday School department or rotunda, seats which can be gathered about this table with the teacher at one side, or changed about to face the superintendent without confusion are the best adapted. Visitors' seats of which there are always more or less necessary, are provided in the gallery. Desks, tables, chairs, settees, as well as special seating for primary and intermediate grades — all adapted to the particular uses — are provided by various manufacturers or constructed from special designs.

The Library system should be simple and thorough. Various methods are adopted, each with its advantages and advocates; a special accessible room should be provided and kept under control of a competent librarian and assistants. Books should be kept in cases adapted to the system. Independent alcoves, with personal checks is quite satisfactory to some, while to others a catalogue system is considered best.

Pews are not complete without cushions unless specially constructed to be so used. CUSHIONS are filled with Fibre, Tow, Moss, Excelsior, Cotton-felt, Elastic felt and hair, practically in merit inversely in the order named. The elastic felt properly prepared being proof against moth or insects, free of dust, etc., and its freedom from packing or matting, preserving its elasticity for years, makes this practically the best filling for sanitary, economical and satisfactory reasons. The coverings used are Mohair-Plushes both crushed and plain, Linen, Velours, Corduroy, Corduroy-Plush, Cordetta, Mohair, Damask, etc., etc. Of these the Corduroy plush is probably the most popular, is obtain-

all colorings, claimed to be moth-proof and possesses great wearing and enduring qualities, while the Mohair unquestionably makes the finest grade of cushions. The popular style of finish is the "Square-corded" and the "Turkish;" tufted in patterns to suit the taste. Hassocks and kneeling cushions are made of materials and styles to correspond with the cushions.

While the proper seating of an audience should be to secure comfort and relaxation so that the services may be enjoyed at ease, there is always a desire on the part of unscrupulous architects to show a large seating capacity in small churches, which must be guarded against. The public will refuse to attend services in a church where there is an uncomfortable overlapping of friends and strangers. For a level floor less than 30 inch spacings should never be considered, with an allowance of 18 to 20 inches for each occupant. Owing to the inclination of the backs of pews or chairs, there must be an increase of space for an elevated or inclined floor or terraces so that on a terraced gallery the spacing for convenience should be from 34 to 36 inches, and on an inclined floor never less than 32 inches.

The aisles as means of egress should be arranged so as to distribute the audience without confusion.

The seating, furniture and furnishing of a church should be so designed and selected as to serve the double purpose of beautifying and adorning, as well as furnishing. The character and style should be consistent and the coloring selected with reference to the artistic treatment of the interior, so as to form a part of a complete scheme of color and design; the character of seating, depending largely on the customs of the denomination for which the church is erected. Book racks, envelope holders, foot and kneeling-stools, with occasionally coat or shawl and hat and umbrella racks are provided, also pew numbers, sometimes carved on the pew-end, and sometimes metal numbers or plates.

The PULPIT has been in all ages an important feature of church furnishing and has been in use from the earliest days. We read that Ezra stood upon a pulpit of wood to read the law. The form and location of the pulpit varies in the more liberal of the Evangelical churches, generally consisting of a platform elevated several steps, and occupied by the pulpit and reading desks, and the seats for the clergy — generally chairs or a divan. With some denominations there is a lower platform in front of the pulpit-platform called the Altar on which is placed the Communion Table, Chairs, etc., in some instances enclosed with a heavy Altar Rail, Kneeling-cushion, etc.

With the established church, more orthodox methods prevail concerning the Chancel, its arrangement, furniture, etc., and are largely fixed by Ecclesiological custom and regulation. The REREDOS and pulpit are quite frequently erected or placed as memorials; their nature both as architectural and ornamental features permitting of a great variety of design and material. They should be designed so as to be a part of the church itself and in harmony with its details, of proper scale, and emblematically appropriate. MEMORIAL PULPITS may be constructed of brass, wood, an artistic combination of wood and metal, or marble and metal. The REREDOS may be of stone, wood, marble, metal or almost any material, decorated with painting or sculpture, and of an infinite variety of forms; the word as now ordinarily used means a more or less ornate wall or screen placed behind the altar, therefore care should be observed in the scale and proportion and character of design.

LECTERNS are constructed in brass, bronze or wood and of various forms, one of the handsomest and most appropriate being in the form of an eagle with outspread wings, conventialized. As the eagle has been used from the earliest times as a symbol of inspiration, the significance and fitness is conceded. Various minor details of furnishing such as Credence Table or Bracket, Alms-boxes, Collection-boxes or Plates, Hymn-tablets, Service-bulletins, exterior notice Tablets, Pew-lists, etc., are more or less essential in the complete equipment.

The character and location of the FONT depends largely on the denomination. Even in the arrangement of the established and Catholic Churches, where mostly determined by custom or Ecclesiastical rule, the location of the Font as well as much of the arrangement of the Chancel is determined by the plan of the church and the method of conducting the services.

CHOIR has two meanings as applied to Ecclesiastical matters. In Ecclesiology, the choir is a certain part of the church, and the Choir Stalls and Desks are substantially a part of the Chancel, while with the more liberal churches the *choir* is the company of singers who conduct the musi-

part of the service, located to suit the arrangement of the house or the wishes of the people. The proper relation of the choir to organ should be considered as well as the relation of the whole to the room. As mentioned in Chapter XI, the acoustical properties of the room must be calculated with reference to the musical as well as the speaking service; their location should be such that these acoustical foci should be coincident to secure the best results, as a house designed and planned in all its lines with reference to the speaker's position will give very unsatisfactory results if his position is materially changed; the same will be the case if the speaker is located in one part and the singers in another. It must be borne in mind that the true acoustical curves can only be calculated with reference to one locality or focus; for this reason the location of the choir back of the speaker and elevated — if properly arranged — is the only proper and satisfactory one in the *larger* rooms. In rooms under the acoustical limits where there is no lack of volume, neutralizing or counteracting influences, features may be introduced which will permit of almost any arrangement, generally with satisfactory results. To secure the best results from the singing of the choir and from the organ, the floor and supports, also the connections of the same with the walls must be considered; the floor should act as a sounding board and attention must also be given to the seats.

All musicians know, or should know, that if they sit on a soft cushion or sofa, the sound of their voices or instrument is much more feeble than when they stand on a hard resonant platform or sit on a hard seat. This is not because the cushion or carpet stifles the echo or resonance but because it does not vibrate. Imagine the character of music produced by an organ resting solidly on a stone foundation, or a solo sang from a stone platform, as compared with one from a properly constructed location; the same may be said of the speaking. The pulpit should be constructed with a false bottom or a sounding board platform to secure the best result. A thick heavy lined velvet carpet may so deaden the vibration and sound that the speaker may have difficulty in making himself heard. How often are *these* matters which do not appeal to the superficial observer considered in designing, planning or furnishing a church? Take a room approximating the maximum of dimensions for good acoustics, where proper proportions and form have been carefully observed, and thus deaden the vibrations essential to generation or propogation, by insulating the singer or speaker; the desired

result is effectually defeated and the room condemned, then the sounding board or reflector is resorted to; the speaker elevates his voice to an unnatural tone out of key with the room, result—discordant vibrations and echoes,—remedy, wires and curtains—verdict, miserable unsatisfactory room, ignorant Architect, etc. *Suppose for instance the sounding board of a piano or violin were muffled or insulated, would alterations of a room in which it was played ever remedy the defect?* Too much attention cannot be given the arrangement of pulpit, choir or organ for the success of the service, all of which should be carefully calculated, designed, planned and specified *by some one competent*, and the same *righteously adhered to.* More depends on this than on the form or materials of the building. No definite set rules can be given, the matter is one largely of judgment and experience or intuition and should never be entrusted to an amateur or theorist. This is an apparent digression from the subject matter of this chapter, but being of vital importance should be considered in this connection.

All floors should be carpeted; for sanitary reasons a solid substantial body that will not wear into an impalpable dust or sweep off, should be selected, properly made and laid on heavy felt lining. CARPETS should be made to fit the room, and placed in position prior to fastening the seats. In the parlors, class-rooms, study, etc., rugs may be used with finished margins to the floors, and mattings or special carpets for stairs, halls, vestibules, etc. Heavy curtains are often used for class divisions, also for the fronts of class-rooms in Sunday-School, forming handsome portieres and more decorative than doors or walls. For dining-rooms, kitchens or drill rooms, as well as the outer vestibules, Linoleum is probably the best covering. For the floors of robing-room or any other rooms in connection with baptistries, a covering of heavy duck canvas, turned up against base board, secured and thoroughly painted is the best.

GAS and ELECTRIC FIXTURES are considered a part of the furnishing, and should be selected appropriate to the purpose and to the several apartments or locations. Where the use of gas and electricity are both considered as an illuminant, combination fixtures throughout should be secured, which are fixtures so arranged that either gas or electricity can be used in them at the option of the user.

Supposing the house to be properly wired and piped, the fixtures selected should be of an approved character as to safety, the conductors should be contained within the fixtures and thor-

oughly insulated by approved insulating joints, the insulating material should be such that will not shrink or crack by variations of temperature or be affected by gas; for this reason mica is probably the best material. The conductor insulation should be water proof, not easily abraded by pressure or motion of fixture, and each fixture should be thoroughly tested for "contacts," "short circuits," or "grounds" before the fixture is connected with supply. Ceiling blocks must be of insulating material or the wires pass through tubes of hard rubber. The safety of the building should be carefully guarded by ample tests prior to turning on the current. Any gas fixtures located near a ceiling should be provided with smoke bells, with proper guards over both gas and electric lamps in any exposed localities. The porcelain candle form of burner is popular and very appropriate for Ecclesiastical work and is supplied for both gas and electric.

Various forms and designs of Chandeliers, pendants, lamps, lanterns, brackets, etc., are used for the various purposes. Auditoriums of various sizes and forms are frequently lighted by reflectors with the best results, which are so arranged as to reflect the most of the light downward and laterally, diffusing it where most required. From the chandelier the strongest light is emanated laterally and upward and only utilized by secondary reflection from the walls and ceiling,—generally better absorbents than reflectors. Owing to the fact that burning gas vitiates a great quantity of air, proper ventilation of gas fixtures is essential; especially chandeliers or reflectors; special pulpit and reading lamps should be provided with flexible or removable connections for both gas and electric lighting.

In the selection of all furnishings the advice of the designing architect should be consulted and considered, as inconsistencies of style, character or detail should be avoided. These inconsistencies may appear trifling but to the cultivated taste may mar the harmony of the whole. As a discordant note in music clashes on the trained or sensitive ear, so the little discords and inconsistencies in detail and design affect the esthetic eye of cultivated taste.

The selection of material as to color effects is a matter which should be left entirely to the mind having in charge the decorative, esthetic and artistic treatment of the whole, who should indicate the color of all upholstering, carpets, curtains, etc., as well as design or select the patterns. As color treatment depends largely on design, and design entirely on the Architecture style or character, the architect who designs the building, should

either design, direct or advise all matters pertaining thereto, otherwise there will certainly be clashing of tastes and interests. Every detail should be subordinate to and a harmonious part of the whole, and not present the appearance of a medley when completed, as would be the result if "A" was selected as the architect, whose preferences lie in Romanesque treatment producing a building irreproachable and perfect in arrangement and design; "B" who is entirely Gothic in taste and education is selected to supply the glass, beautiful in itself, a perfect dream, but very inconsistent in this connection; "C" is selected to do the decorations, he is intensely inclined to the Italian Renaissance of which he produces a masterpiece, then the committee select, possibly Colonial, furniture as that may be the prevailing *fad*, and the customary *red carpet* and *red cushions* because "*always used in churches.*" In the abstract each part may be perfect, but what will be the result when combined? Each has vied with the other in placing the emphasis on their part, having their own reputation to maintain. The true result which should have been secured is *simplicity* and *consistency*, which would cost less and be more pleasing; this can only be secured by the directing influence of one master mind. How often do we hear in the description of some pleasing combination the expression, "it is perfect in all its appointments," "the most pleasing thing I ever saw," etc., yet the person cannot say what part was superior or especially attractive. Each part appears simple when considered alone with no feature to especially commend it. Like all masterpieces it must always be considered as a whole. The most expensive, elaborate treatment is not always the most to be desired. Simplicity if consistent and in good taste is the essential element of true art and artistic feeling.

CHAPTER XIII.

MUSICAL.

ORGANS AND OTHER INSTRUMENTS; CHOIRS, ORCHESTRAS, BELLS, CLOCKS, ETC.

INSTRUMENTS of a rude description comprising more or less of the principles of THE ORGAN have existed from early time. Vitruvius makes mention of an hydraulic organ.

The origin of the organ was in the pastoral or pandean pipe and the courtly flute, but its development has almost entirely been in connection with the demands of the worship of God.

A strong argument in favor of the use of musical instruments in connection with worship, is the ancient Hebrew usage in connection with the Temple services, and are described in the Scriptures as "Made to give thanks unto the Lord" and as "the instruments of God." That the Psalms were written for musical or instrumental accompaniment is evidenced from the directions given with the titles, "Neginoth" meaning "with stringed instruments," "Nehiloth" "with flutes," and "Selah" is thought by many to be a sign for an instrumental interlude.

Harps, Psalteries, Pipes and Timbrels were intimately connected with the Temple worship, and to some extent were used in the Synagogues as well as in private life. The harp and organ are together mentioned early in the history of mankind and prior to the deluge.

On account of the close association of all musical instruments with the immoralities of heathenism, the use was for a time discountenanced in early Christian days. About 400 A. D. however, they began to reappear, and in the seventh century the organ was established as the church instrument, but it was not until the fifteenth century that the organ began to be anything like the noble instrument it now is.

With a history of more than a thousand years in church, chapel, cathedral and monastery the organ is entitled to the veneration of the Christian World: It has called forth many of the most splendid compositions of sacred music, and has rendered services in consolation and lifting up that should elicit a loving gratitude.

The organ is much more than two or three ranks of keys with a collection of stop knobs and a row of decorated pipes standing on an elaborate case, the whole operated by a bellows worked by a handle or motor. The visible or decorated pipes may be but the half of *one* set of pipes while there may be twenty or more sets, each set consisting of from thirty to sixty or more, amounting to from three hundred to five thousand pipes in all, each producing a different tone.

In order that these various tones can be produced, blended or contrasted at the player's will, there is provided an intricate system of wind-trunks, wind chests, canals, valves, etc., through which compressed air is forced or propelled by the bellows, all operated by the manipulation of the keys and stops, in connection with an intricate net work of slides, rollers, springs, levers, valves, and trackers, making a grand organ one of the most complicated of musical instruments.

Owing to the intricacy and complication of the construction

ORGAN M. E. CHURCH, SCRANTON, Pa.

of the organ, the selection and purchase is a matter of much risk. Pipe organs are nearly always made to order and not carried in stock, hence one cannot see or try before purchasing. The sum

of money to be expended is generally determined, and in a general way the schedule of the organ or specification, when proposals are received for the organ complete and in position. Many however pay sad penalties for patronizing incompetent or unprincipled firms.

The situation or location of the organ in a church is a matter of much importance, as the effectiveness of the instrument depends largely but not entirely upon this. The best position is central, elevated and unconfined. A location at one side is liable to be out of the acoustical focus of the room, the sound waves will not travel in unison in different directions, the reflected waves will thus be out of time and often discordant, the tone is more generally diffused by elevation, and in consequence is not so overpowering to that portion of the congregation near it; the height should be sufficient for the construction and allow ample space above. Crowding an organ under a low ceiling or roof is liable to produce an unpleasant tone of a severe or disintegrated character, out of chord with the singers, and is more liable to be out of tune on account of the higher temperature surrounding the higher pipes near the ceiling.

The organ should always be so located, constructed and arranged as to permit the free circulation of air through and around it; this not only prevents dampness but maintains an equal temperature of all parts. The peculiar construction of an organ and the materials from which it is built render it very sensitive to changes of temperature as well as humidity. How often do we find organs so constructed and boxed in, that the cold air existing in a house during severe weather is effectually entrapped, so that when the temperature of the room may be raised to 70 degrees, the air contained within the organ and about the pipes may be 30 degrees. This air is very slowly displaced by the warmer air, over the top of the organ, the cold air only finding an opening through which to flow at the pedals, producing cold draughts on the feet of the organist, and if the speaker should be in front of and at a lower level will be felt on the back of his head, the most sensitive place, almost invariably resulting in "the pulpit cold."

In the arrangement of the modern church, there may be many reasons why the organ cannot occupy an open central position. When Congregational singing is contemplated there is a great advantage in a central location in front of the congregation; with the quartette or chorus choir, *their* position of advantage is central facing the audience, back of and slightly elevated above

the speaker. The symmetrical location of the audience, speaker, singer and organ with regard to the axial line of the auditorium is the most advantageous arrangement; sometimes when the length of room is restricted this arrangement must be changed.

To retain the organ in the centre and divide the choir is almost fatal to the control and blending of the voices of the choir; in such cases the organ must be located at one side, or divided and one half placed at each side with the choir located between (see interior Christ Church, Pittsburg, page 9); some of the finest organ and antiphonal effects have been secured with the divided organ in the hands of a skilled organist. When limited for space or to secure special effects the organ is often further divided and a portion located elsewhere, sometimes a part on the rear gallery, and an echo organ above the ceiling or other apartment.

It is sometimes of advantage thus to reduce the power of an organ giving the mellowed effect, chasteness and charm of distance. In the hands of a competent builder of skill, judgment and resources, an organ can be constructed and adapted to almost any locality. The arrangement of parts and voicing of the instrument can overcome almost any obstacle, and the result of erecting an organ under the most difficult conditions is often the most pleasing and surprising effects.

It must be borne in mind that no church is erected for the display of an organ. The organ must be adapted to the house to which it is an accessory. The builder of skill and genius delights in adapting his work to what men of mediocre talent or ability deem impossible conditions. The organ should always be in scale with the room; *the volume of a small organ can never satisfactorily fill a large church and the best effects of a large organ are only possible in a large church.* In all cases the builder must consider the space, the position, the surroundings and what will be required of the organ, to properly determine the strength of tone or volume and the voicing.

The mechanical construction should be unexceptional, the action should be strong, well seasoned and nicely finished, so that each piece shall work freely, promptly and noiselessly. With faulty action the best organist in the world cannot produce perfect music. The blowing apparatus must be ample to easily meet the demands of the heaviest chord with all stops open; a short winded organ is cheap, tantalizing and unsatisfactory. The metal of the pipes should be of proper quality, sufficiently heavy to produce the full vibration and well made. All interior

woodwork should be properly coated with varnish to prevent injurious effects of humidity.

The power and variety of an organ is indicated by the number and nature of the speaking stops. Each speaking stop involves a separate set of pipes, one for each key of the keyboard. *Mechanical accessories are not speaking stops.* The speaking stops are classified by quality of tone or by pitch; there are four kinds of quality,— the organ, flute, string and reed qualities. A good organ contains stops of all these kinds for each bank of keys, with a predominance of the first two. Within each the stops are further classified according to pitch; those yielding tones corresponding with the key are called eight foot stops, those of an octave higher four foot stops, and those an octave lower sixteen foot stops.

In the ideal organ the stops should be so individual in quality as to present strong contrasts, but so consonant as to blend perfectly. The bellows should be operated by either an electric, water or gas motor. Motors may be placed in the basement, in an adjoining room or within the instrument, should be so constructed and attached as to respond quickly, be positive in action, perfectly automatic in control and noiseless. Organs are operated by the "Tracker," "Electric" or "Pneumatic" actions, or various combinations of the three. With the first, direct connection of the console with the organ is necessary; with the pneumatic the organ may be separated from the console to a limited distance, while with the electric the only connection necessary is the cable which may be flexible and the console movable to any distance or location. Stops and all mechanical accessories are operated in a similar manner; these various improvements have resulted in a lightness of touch and quickness of response equal to that of a piano.

One reason why so many poor and unsatisfactory organs are imposed on churches is because the committees too often give preference to the maker who would give the largest number of pipes and stops for the price regardless of quality. They should give the *vital* matters more careful consideration, or defer the selection to some one especially fitted for the task. The organ should be ordered and selected early, to secure a good organ sufficient time must be given to allow the work to pass through the various stages and departments in a systematic and deliberate manner to insure thoroughness.

Owing to its susceptibility to change of temperature or humidity, it will require occasional adjustment and tuning; the

organ is damaged more by remaining unused than by legitimate use. The employment of itinerant tuners should be avoided; they will never take the interest and rarely possess the skill necessary. Permanent arrangements should be made with some competent man to keep the organ in tune. The case for the organ should be of material and design corresponding with the finish of church, and the general design of exterior should be made by the architect or under his directions to insure harmony and consistency.

The percussive nature of the PIANO unfits it for competing with the organ as a church instrument; it is however better fitted for rehearsals and gatherings, where drill in singing is expected. Wherever it can be afforded a piano in the chapel, lecture room or Sunday School is a useful part of the equipment.

The REED-ORGAN is a convenient substitute for the church organ in subordinate services in either the class or lecture room. When played accurately and smoothly by an artist the CORNET is an agreeable leader for Congregational singing. Other instruments are occasionally used in choir connection, but more frequently do we find the ORCHESTRA in Sunday-Schools or some of the social services.

In the early history of the Church in America, the singing,—when there was any—was by the congregation following some leader, as written music was not used. The transmission of tunes became much corrupted; the entire number of tunes in general use was but eight or ten, the words consisting of the Psalms, generally dictated line by line, and often eight or ten Psalms were sung at a meeting. After a serious contention lasting nearly half a century and which wrecked many churches, new methods of better music prevailed in which the different parts were introduced.

The CHOIR as an accessory or part of the church service is maintained for various reasons, by some upon traditionary grounds, by some because it draws larger or choicer audiences or more adequate lists of pew rentals, by others because a choir that will command public attention and notice will add or give prestige. But in the midst of contests between advocates and opponents, a large party exists that feels that music somehow has a mission and is a part of the service, and that the choir must be considered as a part of the general congregation having special functions, and that its relation to the congregation and the service is analagous to that of the minister.

As the minister is selected to conduct or lead the congregation in all parts of the service or worship, so the choir should be selected to lead in all musical utterances. As music is essentially

a part of the service, the character of same should be considered and the house arranged for it.

Under *Seating* and *acoustics* have been considered vital essentials which must also be considered in this connection. While the precise form of choir — whether solo, quartette, or chorus — is not directly of interest in the construction or planning of a house of worship, *arrangements for its reception are*, and the character of this part of the service should be determined in order that these arrangements may be properly made.

For the leadership of congregational singing a precentor may be deemed best. A chorus most nearly resembles the assembly which it represents and by some is deemed the proper thing, while for special and impressive music a highly trained soloist or quartette is the most effective. The custom of quartette singing is said to be peculiarly American and arose from a lack of musical cultivation or heedlessness of the just management of public worship. All of its advantages can be secured with a chorus containing good soloists; this is the ideal form aimed at in the best English and German churches as well as the American. The subject in this connection does not interest us more than to show the necessity for some fixed form or system, in order that the house can be definitely, satisfactorily and advantageously arranged for conducting the determined forms of service.

It is impossible to trace the origin of BELLS; they appear to have been used universally as well as anciently. Those first in use were of small size and the first records are of those attached to the vestments of the priests. Bells were used among the early Greeks and Romans to denote the hours for public business, assemblage and calls. The first record of bells in connection with Christian Worship is rather indefinite, but dates back to about A. D. 600 when they were used to distinguish the canonical hours. As it was solely for the support of bells that church towers were first erected, the introduction of the turret or bell tower and the church bell may be considered as coeval events.

Prior to the use of church bells religious assemblies were convened by various means. The Egyptians used trumpets after the manner of the Jews: The Chinese employed sounding stones and gongs suspended. In some monasteries it was the custom to call the monks to service by striking the wall or door with a hammer. In many instances the congregation was assembled by some one singing from some elevated or public place, or by runners going from house to house. The Mohammedans to this day have not adopted bells but the call to prayer is still proclaimed by the voice

of the Muezzin from the summit of the Minaret. In the first days of the colonies bells were few and the custom of calling the people together by drums quite frequently prevailed, sometimes on the street and sometimes from the top of the meeting-house. The people were a clockless people with no other means of meeting on time. Sometimes the meeting-house was perched on a hill with a flag used as a signal or a conch shell was blown in the streets.

Associated in various ways with the ancient ritual of the church bells seem to have acquired a kind of sacred character, and for many years in Europe the bell foundries appear to have been set up in the religious houses and the founding attended with great ceremonies. Bells were early blessed with solemn ceremonies and consecrated to their religious duties, were christened and given sponsors, which custom is largely common to the present day.

Many special uses were designated by the names given the bells such as The "Angelus," "Vesper," "Complin," "Sanctus," "Curfew," "Tocsin," and the "Passing Bell."

At one time the custom was to make bells of several pieces of metal welded together; these however lacked vibration. Bells must be of one homogenous piece of metal, cast without strain. By long experience the best forms and proportions have been ascertained also the best composition of metal which is copper and tin. The proportions being different to secure different tones. The quality of the bell depends not only on the nature of the composition but equally on the shape and proportions as to height, width or thickness. The tone of a bell is the result of vibrations which can be determined, consequently it is possible by mathematical calculation to produce any tone.

A CHIME of bells is generally considered to consist of eight bells attuned to the eight tones of the octave or diatonic scale; in nearly every case however a bell attuned to the flat seventh is added, thus rendering the chime capable of producing music in two keys. The tenor or larger bell of a chime is generally hung so it can be rung independently as the church bell while the others are suspended stationary and are sounded by levers and chains leading from the clappers to the position of the ringer where they are attached to and operated by a system of levers.

A PEAL of bells is generally said to consist of three, attuned to the first, third and fifth tones of the musical scale, or of four bells by adding the eighth and are generally rung by swinging.

Chimes and peals are quite the custom in Europe, in some localities, especially Holland they are hung in every church and

public building in endless variety; not infrequently a single tower will contain from ten to fifty bells and professional musicians will be employed to render special programmes on the chimes for an hour every day. In England the practice of bell ringing has been entered into with such spirit as to secure for that country the name of the "Ringing Isle." The feeling pervades their literature also, and in 1618 one enthusiastic writer published a book of 475 pages to prove that the principal employment of the blessed in heaven will be the continual ringing of bells.

The position of a bell in the tower should be no higher than necessary to bring the bell when mounted just above the level of the tops of the adjoining houses; the room or belfry should be arranged to permit the free egress of the sound and tightly ceiled over above the openings, the openings should be as large as possible, and their base or sill should be located at or near the floor. The floor should also be tight and solid. The bells should be properly and securely mounted and connected and the construction of the tower for its reception should be such that the swinging of the bell shall not affect its stability.

Time has been measured in various ways; probably the earliest method was by the Sun Dial and later the Clepsydra, Hour-glasses, and by the burning of candles. The earliest CLOCK of which we have any accurate description was a tower clock. This evidently marked an epoch as there was no method of ascertaining time among the people other than the dial which only marked time when the sun shone.

Clocks were thus placed principally for public use, hence the great advantage, and we may also say necessity for locating them in towers, as the churches were generally erected in some conspicuous locality the clock with dials on the four sides was visible to the most of the people. As they were only thus of use during daylight, connection with the bell of the tower to strike hours during the night was a natural conclusion, and the alarm to awake the priests for early devotions naturally followed. Thus the combination or connection of the tower clock and bell took place early in its history.

As now constructed the clock may be located in a room properly fitted for its reception below the location of the bells and thus avoid all possible vibration, besides being much more accessible for care or winding; the motion is conveyed to the dials by a shaft extending up in a corner of the tower to any desired lofty location. As it is necessary to have considerable fall for the weight the same are generally located in a channel or

recess in the wall of tower open to the basement. When sufficient fall cannot be obtained from the location of the clock the cord is often extended up to a proper height and across a pulley, thus giving the weight necessary descent. The dials may be of stone, wood, metal or glass. When of glass, lights are generally placed back of dials thus illuminating the dials at night. The lights provided are generally gas or electric which are turned on and off by the clock. A tower clock should keep accurate time under all conditions, as the community depend largely on the public clock for accurate time and are greatly inconvenienced when not correct, or stopped.

Where a chime or peal of bells is placed in the tower they must be properly and regularly rang, which means, attention, punctuality and expense. To have the same operated by the tower clock means as ordinarily installed expense and heavy weights which is a great drawback to their general introduction.

Recent inventions however overcome these objections by the application of electricity. The clock may keep accurate time but only a small percentage of the people can get the benefit from reading the dials, while many will benefit by hearing the bells.

In many instances a bell is located in the church tower with no provisions for a clock, and where it is impossible to install one. This condition need not longer exist as the same service can now be obtained by connection with a small wall clock, and the chimes can be automatically operated by electric action. The music is arranged on small wooden cylinders by inserting pins which turn against a special keyboard, the cylinders can be changed daily thus avoiding monotony. Clocks are now arranged to operate by electricity, so that the dials may be on the tower and indicate the time, while the clock may be in any part of the church or in some other part of the city. Any number of clock dials may be placed in the various parts of the church electrically connected and operated from some central clock, which may be arranged to strike hours and quarters on the bells and with automatic carillons and electric apparatus may be arranged to ring the chimes as and when desired.

If it should be decided to place dials on the tower, proper provision must be made in the construction for the clock and the character of same determined. In purchasing a clock the best should be secured, as a clock which will not keep accurate time is an abomination especially if intended as a public time piece. Purchase of reliable parties only who enjoy a good reputation and who will guarantee their work fully.

CHAPTER XIV.

AESTHETIC AND ARTISTIC.

MEMORIALS, DECORATIONS, STAINED GLASS AND MOSAICS.

UNIVERSAL sentiment of respect, regard, veneration or love has prevailed among men of every race and in all stages of civilization, prompting them to some method of memorizing national or historic events or deceased friends or citizens. A memorial may be a commemorative structure, a monument, an illuminated window, a tablet, a mosaic or painted panel, an altar, pulpit, reredos or other piece of furniture.

The simpler memorials being more loving and affectionate in character, seem more appropriate while the structure or monument is more laudatory and better suited to national or public characters or events.

MEMORIALS should be in harmony with the building in which they are placed, and when possible should represent special ideas that are suggested when remembering personal characters by appropriate texts or scenes from the life of Christ or his Saints, also employing many of the emblems and symbols of the primitive church which are sacred by association; there should be some connection or relation between the church and the individual to be memorialized, and some other reason than the gratification of family pride or personal vanity for placing a memorial in a church of any kind.

True DECORATIVE ART means any form of art used in conjunction with Architecture, and differs from other art only in the fact that it is "fitted to a fixed place," as Ruskin defines it. Decorative art may consist of sculpture, modelling, carving, painting, inlaying, pictures or designs formed of colored glass, woven or embroidered tapestries, mosaics, etc., etc., is the superficial part, the ornamentation, enrichment and embellishment of Architectural work, the finish; hence great care must be taken that all may finally stand together as the unit of man's ability.

Decorations apply to the exterior as well as the interior of a building, and the proper color effects as well as those of form, light and shade should be carefully considered and studied under all conditions.

What is customarily known or considered as decorations are those of the walls and ceilings of the various apartments. For the reception of the MURAL DECORATIONS the plaster of the walls and ceilings are generally finished in what is known as Cork-float sand finish. The walls and ceilings are first treated with a "size" to fill the interstices or pores, present a proper surface for the reception of the colors, and neutralize any bad effects the lime or cement may have on the colors used.

Mural decorations are ordinarily called FRESCOING or *Fresco-Painting*. Fresco-Painting properly applies to paintings executed upon plaster while it is yet wet or fresh, and the colors used are mostly earths or minerals (such as will stand the action of lime) ground and applied with pure water, only as much plaster being laid as the artist can cover each day. A large proportion of the best work of the Italian Schools is done in this manner, also the German and French. The practice has to some extent been introduced into Great Britain and this country.

The method generally pursued is to apply the decorations, either water, oil, or some specially mixed and prepared colors, to the wall after the plaster is dry and set, the color adhering to the surface by absorption. Oil colors, if properly applied, will not rub off and will stand repeated cleansing. One objection to oil decorations is the glassy effect which however can be readily obviated.

We find examples of Mural Decorations in the tombs of Egypt three thousand years old in which the colors are nearly as brilliant as if freshly executed.

Mural Decoration is a half sister of Architecture, but they are not inter-dependent. Good Architecture *can* exist without painted embellishment but mural decorations *cannot* exist without some architectural work or scheme. All good decoration should have an Architectural basis and should be a part of the Architectural scheme, and should fall into the effect of the whole structure as effectually as the features of Architectural detail, regardless of the form which the added color takes. Mural decorations may be a solid mass of color accented by a few lines and conventional arabesques, or it may be divided and subdivided into base, dado, walls, friezes, cornices and ceilings, with bands, borders, lines and ornament innumerable or it may be allegoric, emblematic, symbolic or historic representations. The

fundamental principle must not be forgotten that it is a *subordinate part only of an organism or structure* and as such must *harmonize and balance.*

The choice and disposition of coloring is undoubtedly the most important part of decoration. By *good* color, that which is intolerable in shape may be made agreeable, while what is excellent may, by *bad* coloring be quite spoiled. So delicate and intricate are color effects, that nothing but the instincts of an artist's taste can give the most successful results, aided by all the training that a lifetime can hold.

A competent artist should be employed, who could be intrusted with the work, and his ideas should not be warped by suggestions of amateurs who possibly daub in color or decorate plaques and imagine themselves possessed of artistic genius; *those who are wise in their own conceit are dangerous advisers.* Many an otherwise fine interior has been spoiled by the officious meddling of those who are considered specially talented by their friends, "Wad some power the gifti'ed gie them twa see theirsels as ithers see them." Color is one of the most invaluable elements placed at the command of the architect to enable him to give grace or finish to his designs. There is nothing that enables him to express his meaning so cheaply and easily, and at the same time with such brilliancy and effect. For an interior it is absolutely indispensable, and no apartment can be said to be complete until it has received its finishing touches from the hands of the artist.

Internally the architect or artist has complete command of the situation; he can suit his design to his colors or his colors to his design. Walls, ceiling, floor, furniture are all at his disposal and he can shut out any discordant element that would interfere with the desired effect.

Externally, this is seldom if ever the case. A façade that looks brilliant and well in noon-day sun may be utterly out of harmony with a cold gray sky, or with the warm glow of the setting sun full upon it, and unless all other parts and objects are thereby toned into accordance with it, the effect can seldom be harmonious.

While there is no reasonable doubt that the Greeks painted their Temples both internally and externally, they always placed them on heights so they could be seen against the sky, and had an atmosphere they could depend on of almost uniform, unvarying brightness. Had their Temples been erected in groves or valleys, or in such a climate as ours, they would not have ventured upon such treatment. Notwithstanding this, the color of exterior

should be considered and materials selected with reference to their color and the situation and environment. Thus a building that would look well nestling among trees would look hideous on a sandy plain. In cities the application is difficult on account of the impossibility of controlling the selection of color for the adjoining buildings, often producing violent and unpleasant contrasts.

But for interiors, each is independent and the desired effects may be obtained without regard to any other conditions.

We must not however consider color absolutely indispensable. The majority of cultivated and travelled persons would probably vote the Taj Mahal at Agra as making the greatest impression of pure poetic beauty of any Architectural work, a structure of dreamlike beauty absolutely destitute of sculpture or painting, the use of either being forbidden by their creed.

All color is classified by artists as "warm" and "cold;" reds and yellows and mixed colors in which these colors predominate are called "warm." Those in which blue predominate are called "cold." Primary colors are rarely used; innumerable shades, tones, suggestions or effects are secured by using colors in combination. Rooms may be made to appear larger or smaller, higher or lower, cheerful or gloomy, depressing or elevating by color effects alone. There is much in the true artistic instinct or intuition that cannot be acquired, but is a natural gift and should be guided by the proper sentiments and feeling secured by careful ecclesiological study.

The artist selected should not be allowed unchecked latitude, the church must not be made an ecclesiastical or architectural picture gallery or a medley of ornament. *Construction may be ornamented but ornament should never be constructed.* Ornamentation of parts may be *modelled* thus securing greater richness of effect; all details of ornament must be consistent and in harmony with the architectural style and always subordinate, and conventional forms largely used. The windows and panels as well as the walls should be considered as a part of the scheme of decoration. That sentiment or practice which employs one artist to execute the decorations, another the stained glass and another the memorial windows is to be deplored, also the customary practice of having these matters in charge of and determined by a committee who have been appointed for reasons of *policy* and *are no more qualified to pass on such questions than they are to preach*, but must in the brief opportunity show their knowledge and authority, generally determining such vital questions from small

sketches submitted from which *no expert with the most lively imagination could draw a conclusion or form an opinion.* Personal preferences regarding color effect in the abstract generally prevail, and red or blue schemes are selected simply because of a personal preference for those colors. No conceivable opinion regarding the effect of a stained glass window can be formed from a drawing except by those accustomed to this method. The drawing is perfectly flat and opaque, the window brilliant and transparent; the degree of opacity must be determined by its exposure to the light. Finely executed and brilliantly colored drawings are invariably selected generally without reference to fitness, appropriateness or consistency in combination with all the other details or features.

All artistic work such as the Mural decorations, Stained glass, Mosaics, colors of furnishings, designs of special furniture, wood used in finishing and the character of treatment of same should be directed, designed or selected by one person. One practice should be condemned and that is the common use of the heavens as a decorative adjunct in ceilings. This is a phase of work executed by a class of Italians who delight in such features as the rising sun, gathering clouds, star bedecked sky, etc., as suitable ceiling decoration. Although such ideas are as old as the Romans, we find it hard to accept them as forms of artistic or esthetic expression, removing that sense of protection and security essential by painting away the ceiling and roof.

COLORED GLASS WINDOWS were essentially a component part of medieval Christian Architecture and one of its greatest glories. They are the most brilliant and dangerous parts of color decoration liable not only to color objects themselves but the light in which they are seen.

The Romans were the first to use glass for windows; its introduction to general use was during the early years of Christianity. The panes were about seven to ten inches square of a greenish color and not transparent: colored glass was early produced and used on account of its brilliancy.

In the early days of the church the windows were filled with slabs of marble, stone or stucco pierced in such a way as to form patterns and filled with colored glass; some examples of these windows still exist.

The inherent beauty and quality of glass as a transmitter of light and a decorative material was first really brought into play through the requirements of Gothic Architecture. In this it was necessary that the filling should be strong enough to keep out the

weather and transparent enough to admit the light. In this form of Architecture the wall spaces were necessarily small and the openings large, hence the windows were the only places where the decorator could display his art, as far as it depended upon color. But, as glass was only made in small pieces the glazier was compelled to make his lights into a mosaic by the use of strips of lead having lateral grooves for the reception of the edge of the glass. The leading first on simple lines soon assumed more complicated forms; the glass was selected with regard to color. By these means the innumerable geometrical designs and patterns were first introduced. Owing to the vast proportions assumed by the Gothic windows (in some instances twenty-five feet wide by eighty in height) there was but little wall space left for decoration, hence the decorator was obliged to turn his attention to the windows.

Owing to the lack of education, scriptural lessons and scenes from Bible history were portrayed on the walls and windows of the churches in such a way as to become plain to the meanest understanding, and even the ignorant could read the lessons they inculcated. All this came about gradually so that by the twelfth century picture windows became an almost necessary part of every ecclesiastical edifice. The painting consisted in the application of transparent pigments to clear glass protected by placing over it another sheet of glass held in place by the leads; this only preserved it for a time. About this time the art of painting on glass with fusible metallic colors was discovered, which made the paintings as durable as the glass itself. The irregularity of the surface and texture of the glass made in the early days made it more adaptable to mosaic effects than the later and more perfect glass. The so-called defects ingeniously worked in, increased the brilliancy and richness and gave to this early medieval glass that gemlike brilliancy for which it is noted; paint only being used in outlining or shading. We cannot but admire the ingenious combination of color, rich effects and brilliancy of this glass, although much of the beauty is marred by the grotesque, stiffly drawn figures inclosed in long sheath-like vestments of many vertical folds with the deep red or blue back-grounds, most of the figures being represented within borders and under a low crowned, rude and simple canopy out of proportion to the figure and badly drawn known as canopy windows.

During the thirteenth and fourteenth centuries, the art of making picture windows attained perfection, and every one of the hundreds and thousands of churches and cathedrals which were

erected in all parts of Europe up to and including the sixteenth century were adorned with rich windows of colored glass. The drawing shows great improvement although all details are still conventional. At all times however the choice of subject was limited by the paramount object of all ecclesiastical decoration at this period, viz.: — the instruction of the illiterate and the promotion of piety. Running through all the picture windows of this age there was a symbolism of great beauty, sermons which reached the heart through the eye rather than through the ear, a method unsurpassed in its subtle and lucid exposition of truth by any other system ever devised by the genius of man. All figures were introduced to represent scenes from Biblical history, the lives of the Saints, symbolic portrayals of the dogmas of the church, or Christian attributes, virtues or sentiments. Conventional forms were introduced, together with symbols, emblems and allegorical representations, all with a meaning perfectly intelligible to those familiar with Christian Iconography.

With the reformation came the decadence of Ecclesiastical art, especially the glazier's art. The religious bigotry of the sixteenth and seventeenth centuries, the weakened faith, carelessness and political fanaticism of the eighteenth resulted in an iconoclastic wave of sentiment which almost destroyed Ecclesiastic art.

Beginning with the present century there has been a revival of Ecclesiastical art, and not only are we experiencing a Renaissance in all departments but a new and refined art has evolved. The branches that developed most rapidly were Painting and Architecture, among the hand-maidens of the latter the glazier's art has taken a leading position. This has developed into several schools: — first among which may be mentioned the Munich School whose chief aim seems to be to make of the windows,— transparent pictures; expressing theological ideas or historic facts, in which the glass is used as the background on which to paint the picture and color is subordinate to form, the glass used is even in texture, thin and uniform in color, the lines and shadows being produced in enamels, results in rendering the windows hard, opaque and heavy; and pictorial rather than decorative being better adapted to opaque walls than transparent windows.

The English school may be criticised for its attempt to imitate the windows of the middle ages, due largely to the fact that much English work consists of restorations, wherein they reject the glass with blemishes, using the more perfect only.

This English work is condemned as being cold in color extremely thin and conventional.

The French have a strong tendency to the Munich or German School, looking upon colored windows as easel pictures with no leaning toward the medieval processes or effects, although there are incomparable examples in their Cathedrals.

The principal difference between the foreign and American schools is that the American artists consider the window as a *transparent mosaic*, and have adopted and developed the mosaic system of the middle ages with great and constantly increasing artistic success, and seek for perfect color effects rather than form and to secure depth of color, light and shade by the use of selected glass. For drapery and many similar effects the glass is modeled when in a plastic condition, thus securing the desired effects without the use of painting and retaining the brilliancy of the glass under all conditions. In the American window the only portion painted is the flesh of the figures which is done with fusible metal oxides. It frequently occurs that the desired color effect or the proper depth of color, can only be secured by placing a piece of glass of one color over that of another, producing the desired effect *in combination*. This process is called *plating* and is sometimes repeated several times until the desired effect is obtained.

The leads and leading are carefully studied so as to bring out the design, every one being a line in the composition. On all larger windows stay bars must be used to stiffen the glass against wind, which are secured to the sash or jambs and wired to the glass by copper wires soldered to the leads. Leads as light as possible are used, well soldered at all points and should be tinned to protect same against corrosion where there is much sulphuric acid in the Atmosphere.

There are three modes of coloring glass: I, *Pot-metal* in which the color is mixed up with the molten mass. II, *Flashed*, *Covered* or *Coated* formed by uniting a thin layer of colored glass with another layer either of a different color or colorless. III, *Painted*, the white substance being painted on and then the color or pigment burnt in.

The coloring materials are in all cases metallic substances; some will render the glass too opaque when mixed with the glass, for this reason flashed or coated-glass is used in nearly all work for certain colors.

The glass used for modern church windows is of many grades, characters or qualities. The cheapest grade of stained

glass is the *Cathedral;* which is a rolled glass receiving impressions from the rolls imitating the appearance and effects produced by the medieval workers, is made in all colors and tones all of pot metal. "*Cathedral*" and "*Stained Glass*" to many are synonymous terms and are used in speaking of all classes of colored glass windows. Strictly speaking this is the cheapest form of ecclesiastical glaziers' work. The early attempts at stained glass work, (and to some extent practiced yet in this country,) consisted of sheets of tinted glass decorated with some opaque enamel color in stencil and in conventional forms, with some ornamental work in transparent colors, all fixed by firing. This class of work is not durable and in artistic excellence is but little better than the semi-transparent paper imitations of stained glass which are a sham and which the church as a teacher of morals should not countenance. The cost of the cheaper grades of Cathedral glass, economically leaded in geometric designs or quarries is but little greater, if any, than these imitations and is by all means to be commended.

When desiring better grades of glass or more brilliant effects, *Ondoyant* should be selected which has a rippled or irregularly corrugated surface, obtained in all colorings and effects, some produced by partially mixing various tones of colored glass when in a liquid state, thus producing exceedingly beautiful clouded and shaded effects and blending of colors. Degrees of opacity in this glass is obtained by using the glass as it comes from the rolls, while the brilliant, sparkling transparent effects are obtained by using *muffled* ondoyants. The more brilliant ondoyant glass, known as venetian, is largely used for domestic work; muffled venetian glass in sheets is also largely used for glazing windows, doors, screens, etc., etc., admitting and diffusing a large portion of light, still not transparent. For the most effective and the larger portion of modern stained glass work, *Opal* or *Opalescent* Glass is used; this is glass with which some mineral is combined rendering the glass semi-transparent. Generally the coloring consists of imperfect mixtures of various colors or shades producing clouded and striated effects. Opals may be flat, rippled or modeled and are made in every conceivable color, shade or combination. What is known as *Drapery* glass is opal glass modeled while in a plastic state to represent drapery, clouds, etc. The modeling is of a mechanical character, the effects being largely accidental and rarely special. The glass is then selected, cut and fitted so as to reproduce by the modeling the effect desired by the artist who has designed the window and executed the cartoons therefor.

This process and method is *purely American* and is not practiced to any extent in Europe; owing to this fact but little, if any, modeled glass is produced in Europe. For all fine figure work a quality of glass known as *English Antique* is produced or imported which is smooth on one side and rough on the other, made in all various colors, largely imitating the peculiar effects in old glass which are a result of time. The figures are painted on the sheets of glass with various mineral paints and then fired or fused into the glass; a quality of glass that will stand perfectly this process without loss and without being effected by the intense heat to which it is exposed — by changing the colors — is necessary. The imported glass seems superior to the home made article for this purpose.

Iridescent glass is a peculiar surface treatment more adapted to mosaics or small work in which transparency is not an essential. In making up stained glass windows certain effects are secured by the use of *jewels* which are pieces of glass of various brilliant colors and degrees of transparency stamped or cast into various forms; small glass discs called *bulls-eyes* and larger ones designated as *roundels* are largely used to secure certain effects.

The various characters and qualities of glass are innumerable, the foregoing covering the principal grades. Each manufacturer artist and dealer have their own technical or trade names. Thus drapery glass may have a different name with each and really mean the same thing. A finely executed window, which is a

work of art, may be entirely a mosaic, wherein all the effects are secured by selecting various colored, clouded or shaded glass; artistically cutting and leading them to produce the desired effects, securing perfect representations of the drapery by proper selection and in which the only painted parts are the flesh parts of the design. This is a distinctively American creation and the modelled effects applied equally to foliage, plumage, clouds and the different parts of landscape effects. Beautiful color effects are secured by plating one color over another in which the smooth glass forming the base of design is placed on the exterior, the rougher plating being on the interior, producing beautiful prismatic effects in proper lights. ART GLASS is a name that applies to any artistic combination of colored glass, generally of a domestic character.

MOSAICS have been used ever since the period of greatest culture among the ancients, wherever decorations were needed that would resist wear, destruction by the elements and the decay of time.

Because of their enduring quality they have been the medium of color decorations in monuments and monumental buildings; even where destructive influences were practically excluded, for the idea of endurance which underlies a monumental structure must extend also to its decorations.

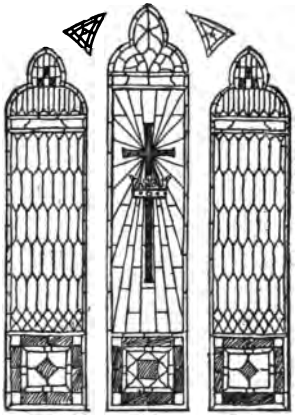
Glass, stone, marble, shells, hard burned clay, enamels and various substances are used in forming the designs, selecting materials of various colors using precious stones and metals in many instances, so that the medieval churches shone with gold and color.

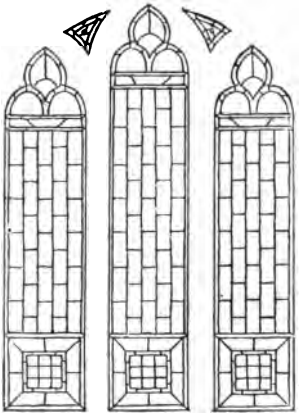
Mosaic art is entirely separate and distinct from painting in that all artistic effect must be produced and secured by the combination of the particles of colored materials, durably set in cement in position, thus perfectly reproducing the most celebrated frescoes and oil paintings, sometimes requiring as many as twenty-five thousand different shades.

Mosaic work is applied to all parts of the edifice, the walls, ceilings, columns, arches, exterior façades, floors, pavements, etc. In American Ecclesiastical work, mosaics are generally employed in the Mural decoration of the Chancel and the Chancel furniture, Memorial tablets, panels, etc.

Mosaics are produced in which the metallic effect of gold is secured by an enamel flashing or plating thoroughly protected by glass, thus reproducing the rich venetian golden mosaics at a moderate price and more durable than the metallic mosaics.

The remains of the pavements of the Atria and Aulae of Roman houses in England and Germany, have shown that mosaics of burned clay tesseræ were neither worn away by the tread of feet or disintegrated by the action of frost as were those of stone. Floors of porches, vestibules, corridors, lavatories, etc., should where possible be laid with tile or mosaics, which, for endurance and sanitary reasons are superior to any other material.





The preceding plates illustrate four different methods of treatment for the same window; the first represents the window considered as a whole, the mullions cutting across the picture and is a "figure window." The second represents the center as a "figure window," flanked by mosaic windows of conventional design and detail. The third represents an emblem in the central window, flanked by windows of geometrical detail; while the last indicates the cheapest treatment — a plain leaded window in quarries; these only indicate a few of various methods of treatment. The divisions of a window are called days, the window shown being known as a three-day window.

CHAPTER XV.

SECURITY.

BONDS, GUARANTY, INSURANCE, ETC.

UNTIL the millennium begins men will not be able to exist without courts, law and lawyers. When man was in a state of nature, before what the philosophers call the social compact was entered into, the law that prevailed was the strong hand.

Property belonged not necessarily to him who manufactured it or found it, but to him who had the physical ability to prevent other people from depriving him of it.

> ". . . The good old plan,
> That they shall take who have the power,
> And they shall keep who can,"

is not entirely a thing of the past, much as we may talk of the influence of Christianity, our advanced civilization and improved morals, that old theory seems to underlie almost every legal process of to-day. Hence the necessity for security and guaranty of property and individual rights.

In the processes of the social evolution, the man first righted his own wrongs according to his natural reason or his physical ability; next the family took up the administration of the law, then the tribe, and lastly the nation. Each change was for the better and an approach toward impartiality and justice. Each decision established a precedent which gradually grew into law all based on right and common sense. Our present laws are not perfect nor are they perfectly administered, but the whole world knows that the English speaking people have the best laws known to man, and that the rights of the individual or society to property are fully recognized, secured and protected. It is the duty of every individual as well as society or corporation to have their acts conform to the law to entitle them to legal protection or redress, and to the extent possible evade recourse to the law.

In the transactions we have under consideration, which include the erection, construction or remodeling of Ecclesiastical Edifices, the rights of individuals, societies and corporations are involved. A written CONTRACT is but the evidence of an agreement specifying the terms, conditions, etc. The object of a contract is to avoid possible misunderstandings and consequent legal proceedings, hence the contract should be explicit and strictly within legal bounds. To enjoy full legal rights and powers every church organization should be incorporated according to law, and can only contract as they are empowered by their charters. Two parties are essential to any contract. The first party proposes to render certain specified service for a designated consideration; the acceptance of this proposal by the second party constitutes a contract or agreement.

Legally, a written agreement will take precedence of a verbal one, being sustained by evidence, as consent is vital to a contract which is proven by the signature. An unconditional proposal may be withdrawn at any time prior to acceptance. For this reason conditions should be specified when soliciting proposals in order to secure any benefits which may pertain to an advantageous proposal, at least for a limited time.

PROPOSALS are generally secured by the deposit of a certified check as forfeit, or some of the ordinary forms of guaranty. There should be an option for acceptance within a specified time. An acceptance may be verbal or written, and it is well to note in this connection that a written acceptance *takes effect with the time same is made and mailed* or *delivered in person or to messenger*, and *not from the time of its receipt by the proposer.* Therefore it is well to retain evidence of this, as a withdrawal may be void even when received before the first party receives notice of acceptance *the withdrawal only dating from its receipt.*

No one has a right to *accept* an offer except the party to whom it is made or their legal representative, and a *refusal* of an offer cannot legally be retracted without the consent of the other party. Once an offer is refused the matter is ended.

A contract made under a mistake of the law is not void. Everyone is supposed to know the law and ignorance is no excuse. This only applies to such contracts as are *permitted by law and clear of fraud.* All contracts in connection with buildings are made for a consideration. The party proposing to render service or supply material is considered the first party, and the one who accepts the proposal the second party. The security of the first party lies in the right given by law to place a lien on the premises,

of which the work executed forms a part — or other legal recourse — the entire property and credit of the society being pledged by a properly executed contract.

BUILDING CONTRACTS are seldom entered into for the construction of public buildings or extensive works of any character without *security* for the faithful performance of the work, which may be in the form of a surety, bond or guaranty. It is well to note the difference; a surety is a co-maker of contract, while the guarantor never is a maker. A surety's promise is to meet an obligation which becomes his own, on the principal's failure to meet it, the surety signing the contract with the principal as a party thereto, while a guarantor's promise is always to pay the obligation of another.

A GUARANTY is a separate, independent contract by which a person undertakes in writing, and for a valuable consideration, to be answerable for the performance of some duty in case of the failure of the other party primarily liable to perform it, is sometimes called a BOND, and as such should specify a certain sum of money, payable to a certain party, at a fixed time to guarantee the performance of certain acts, which being done the bond becomes void. While it is sometimes conceded a bondsman's privilege to take charge of and complete a contract according to the terms thereof, the real responsibility lies as guaranty against any expense additional to the contract price, or damages for excess of time, etc., the limit of liability being measured by the amount of bond, the party of the second part taking charge of and completing an abandoned contract or one from which the contractor has been suspended or failed. All conditions should be embodied in the contract, as any penalty or damages otherwise secured is generally at the end of litigation.

Parties to a contract should carefully live up to all the conditions thereof in order that the security be not released by some violation. Material changes in the contract or time without his assent will discharge any surety or bond. Payments made before due or in excess of the amount due may also discharge surety. Any radical variance from the terms of contract by either party may be considered a violation, and the offender cannot with good grace enforce the conditions on the other party.

In case of the death of contractor prior to completion, the work will pass to his legal representative, who is bound by all the conditions of contract.

It is the duty of those placed in charge to properly and amply secure the society which they represent against loss in

every transaction and in a legal manner, and to avoid litigation to the extent possible. There is generally a clause attached to building contracts as a security against excess of time, stipulating an amount agreed upon which shall be considered as liquidated damages. This amount is rarely carefully determined and is quite often in excess of any possible actual damage. In this connection it might be well to cite the following rules deduced from the decisions of the courts on this question. "Where the sum fixed as liquidated damages is manifestly above the injury sustained, it will be held to be a penalty, and only actual damage can be recovered. — When the contract is for a matter of uncertain value, and the sum *is fixed* to be paid on the breach of it, the sum fixed is recoverable as liquidated damages.

"Where the payment of the money appears to have been intended only to secure the performance of the contract, it will be construed as a forfeit or penalty. Where a contract contains a number of conditions and the penalty only applied to one of them it is not recoverable as liquidated damages. Forfeits and penalties are abhorred especially in Courts of Equity and will not be enforced. The object of the courts and the law is to make the parties whole, and where this is accomplished the ends of justice have been met. Hence it is difficult in any case to recover upon a breach of the contract more than the parties have been actually damaged."

It has been generally held by the Courts that if a building should be destroyed by fire caused by lightning, during construction, the contractor is not relieved of his obligation to finish it by the time specified. This applies to a complete contract for a building and not for partial service. In a complete contract, the contractor agrees for a certain consideration to erect and complete a specified building. The payments are made *on account* and are in no way an acceptance of any part of the work, and the contractor cannot be released of his obligation except on the conditions of contract, while a contractor for a certain part of the work may prove completion of his part or acceptance before completion of the whole.

The contracts should be written with care so as to properly secure and protect all parties against all contingencies in case of damage or destruction by fire, storm, lightning or accident. The contractor may be financially unable to complete the building, or — unless bound to do so — may refuse, and having already received money on account, his abandonment may be at a serious loss to the owner. The security or bond should cover all such

contingencies as guaranty that all accounts and bills for services and materials—for which the building or owner may be held liable—are liquidated. The owner may demand further guaranty in the way of receipts, certificate from the clerk or recorder of liens, or an indemnity bond before final acceptance, payment or release. Further security against loss by fire, lightning or storm is afforded by *Insurance.*

In taking out INSURANCE on a building during erection, it is well to always consider the interests of the various parties. If erected by parceling out the contracts the *owner* should effect the insurance. If the contract calls for a complete building the owner has no *direct* interest, but if he advances money on account he has an *insurable* interest. Under some rulings the contractor having no tenancy cannot insure or has not the advantages of the owner. For these various reasons it is best during erection to effect *joint insurance*, payable in case of loss as the interest of the parties may appear, the division of expense being determined and agreed upon. Should a loan be secured for the purposes and during the period of erection, secured by mortgage on the property, the interest of the mortgagee should appear as a party in the insurance jointly with the second party.

As soon as the building reaches an insurable stage, insurance should be effected. The better and more satisfactory method is for the owner to arrange for the permanent insurance for a term of years, including a building risk covering a certain period; the amount of risk during this period being determined monthly; thus a builder's risk will gradually merge into a regular insurance. This is more secure and economical than to take out a builder's risk alone during erection. In case of loss the insurance should be used to make good the said loss, consequently will be entirely payable to the builder, and should it not be sufficient for this purpose, the builder must make it good at his own expense—which refers to complete contracts. With partial contracts the insurance would be payable to the owner or a trustee for the benefit of the several contractors, unless they had effected independent insurance.

Should the project be abandoned after a loss the owner would have a first claim on the insurance to the amount of money advanced on account, the remainder going to the contractor unless attached as damages; the recourse for damages for abandonment however would properly be against the security or bond. In the event of the *owner* abandoning the project after a fire loss, an agreement to that effect will be necessary else he will be liable to the contractor for damages.

The insurance should stipulate the method of payment of loss; where both parties are interested in a risk it should be used only for the restoration of the work, and for this purpose may be held by a trustee, payable on the certificate of the Architect or superintendent, unless the owner is satisfied he is amply secured, or it should be determined to abandon. In any event the owner should be cautious regarding the acceptance or use of any insurance money in the case of loss, as acceptance or ownership is not acknowledged until completion, and the fact that the owner has received money or benefit, for damages may be construed into an acceptance of the work at that stage, and effect a violation of contract which may render same void. The owner should avoid anything which may be construed as an implied acceptance at any time.

The rates of insurance depend largely on the character of the building and its construction. It should be constructed in such a manner that insurance may be obtained at the lowest rates and then carry policies sufficient to cover any probable loss. The additional expense for a better construction will not be great, must be met but once and will not be nearly as annoying as the constant recurrence of bills for larger policies and higher rates of insurance necessary for proper security in a poorer building, thus saving money, annoyance and apprehension. Bills for insurance are probably the most reluctantly paid of any, being without any apparent returns.

The modern church comprises many apartments seldom visited except when occupied. The sexton or janitor and assistants being generally the only persons in the church during the week, do not and cannot inspect everything or be every place. Metal flues may rust through or burn out, some of the insulation or connections of the electric wires may be destroyed by friction, mice or a short circuit. These accidents generally occur in a remote out of the way place and gain dangerous headway before discovery. When starting fires or turning the electric current on the building the attendant has duties preventing any inspection or examination. New buildings should be thoroughly inspected, tested and watched when first used to see that all are properly connected and adjusted. Periodical inspection at least once a year by competent persons which the insurance or electric companies will furnish should be made. All Apartments wherein heat is generated and fuel stored should be isolated from the rest of the building, constructed fire proof with ample flue connection wherever possible.

Prevention is the best surety, money consideration will never make good the damages of a fire. The incidental and consequential damages are always out of proportion and in excess of the damages of the fire itself. The damage of smoke and water to the woodwork, decorations, stained-glass, pulpits, pews, cushions, carpets, etc., are often irreparable and sad mementos of disaster and sometimes equivalent to a total loss. While some of the damages are irreparable without complete refurnishing and sometimes rebuilding, a total loss — even when met by the compensation of full insurance — cannot replace the loss or make good all damages.

There is an affectionate interest and association connected with a church which has come to us by much generous giving and self denial that grows as the years pass by. No new church can fill the place in the lives and affections of the older members, especially if the one lost has been adapted to and met all the requirements of the service. This feeling should be respected and encouraged, and how better than by safe and secure building, and as there always is a risk, neglect to insure is inexcusable. In case of loss how severe will be the criticisms of the old and faithful members, if there is no insurance or it is insufficient, or if the fruits of their self denial and care has not been properly cared for by those having them in their official charge; and how depressing will be this influence on an effort to provide funds for a new church.

CHAPTER XVI.

SEQUEL.

IN a professional capacity,—having associated with many of those who have been identified with the inception, development and improvement of the modern forms of service,—I have been familiar with the various theories and ideas as to the essentials of this service, and the various ways and means suggested and utilized in endeavoring to meet them. In making the application many theories have been found impractical, and many experiments have resulted in failure.

The information given herewith is the result of this experience, extending over years and is given in the hope that others may benefit thereby, as but limited advance can be made on any lines if each must secure his own experience as the result of similar experiments, and is unable or unwilling to benefit by that of others.

In connection with this advisory matter which is a compilation from many reliable sources, combined with personal experience and observation, some indication of the present development showing what has been done and is being done will undoubtedly prove of interest and advantage.

For this purpose a series of plates has been prepared indicating various arrangements adapted to the present requirements as well as anticipating increased work—also plans showing various stages of the evolution. In presenting these, only such as have been tried in actual practice and have been found practical, satisfactory and of advantage are given and are not intended to show fixed forms or arrangements, but rather types of the various developments or forms, indicating principles and systems. In practice, the plans must be *adapted to each individual case*, governed by the requirements, expense, location and various other conditions; the variety of plans which may be developed from these as types is unlimited.

These have been placed at the conclusion and as a sequel to this work, in order that the arrangements and advantages may be better understood and appreciated after ascertaining more fully the governing reasons, influences and requirements contained in the preceding matter.

To give a distinct and categorical answer as to what the church of the future will be, would be equivalent to foreseeing what has not yet been invented and to describe what does not yet exist. It is rarely possible, or the work of any man or set of men, to invent a new style or type; we must go on improving what we have. The new comes as a growth or evolution, improvement comes to meet a demand; this demand must arise from the public, it cannot come from the profession whose mission and work is to meet it.

What is wanted to insure progress toward perfection, is that we shall have a public with feeling to desire good work and knowledge sufficient to judge it when they see it. The public mind must be disabused of the idea that Archaeology is Architecture or has any connection with it. *Architecture was a living art and should be now.* Design and plan should be arranged according to the dictates of *common sense* and not according to the lines laid down ages past under entirely different conditions.

Having been connected with the development of the MODERN CHURCH almost from the beginning of the movement, devoting my time and attention to ascertaining the essentials, becoming familiar with the principles involved and exercising my professional ingenuity in endeavoring to devise buildings adapted to the increasing requirements of the service as a specialist; the history of my work is practically a history of the developement of the church buildings as we find them to-day, with such divergence as marks the influence of various conditions and individualities. The Modern church — as we consider it — can be readily traced back to one origin, and the entire evolution has taken place within half a century. I will briefly review to substantiate the foregoing statements.

Fifty years ago the Sunday School as we now know it had no existence. Various advanced minds were dissatisfied with the methods of teaching the Bible. The restlessness which precedes some great movement soon became manifest. Many felt the want of some improved system for conducting and enlarging the work of the church; the influence of the master minds was felt in many isolated and distant localities indicating that the movement was spontaneous, the result of unseen influences and not the work

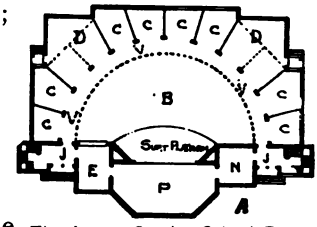
or influence of any one man Gradually the workers became acquainted with the work and ambitions of one another, the various forces and influences exchanged ideas and systems began to develop. Less than fifty years ago the first attempts were made at *grading* the Sunday School; this soon opened the eyes of the workers to the great lack of trained assistants as teachers. The first training school or normal class was organized about 1857, in which various denominations were represented; this proved a move in the right direction. It at once appealed to the intelligent workers as the germ of the system which they had all felt as essential to the future of this new department of the church. The idea proved catching and was rapidly introduced; the influences were quietly but surely at work, so that in 1861 the first Sunday School Institute of America was held, and it was here that the idea, that the Sunday School teacher should be prepared for his work as well as the secular teacher for his, was first publicly advanced which is now the generally accepted idea and a fundamental principle of the whole modern system.

At this gathering the Modern Sunday School first began to take definite form. To rapidly develop a literature was necessary. Handbooks and manuals soon followed one another, periodicals and lesson leaves aided in perfecting the organization of a system, interchange of ideas widened the horizon of usefulness, denominational lines were found too narrow, the system soon became national, and later through the influence of Bishop Vincent it was made *international.* The rapid, almost miraculous growth of this work has been universal, and so thorough that systems which were adapted in the early days for its most efficient management, were so carefully thought out that but little change has since been made, in the main or governing principles.

Prominent among the systems involved is that of *grading* the schools; in each instance however on attempting this to any extent, the inefficiency of the buildings then in use became apparent. Early in the days or stages of Sunday School development, a school was in operation in Canton, Ohio, under the supervision of Mr. Lewis Miller,— one of the founders and President of Chautauqua Association,— who made practical application of the grading system, adapting it to the work of the schools of several churches, but the successful operation was seriously hampered by inadequate buildings.

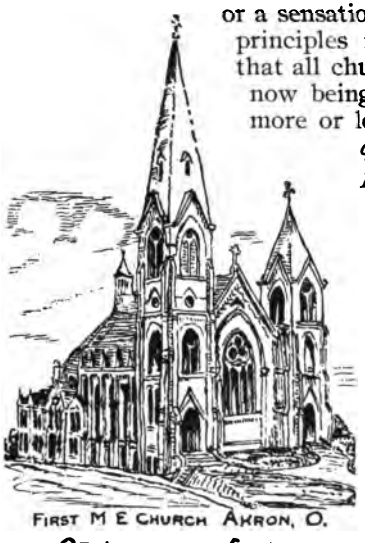
To overcome this Mr. Miller proceeded to develop plans for a building adapted to the special requirements of the service. Later — removing to Akron, Ohio, he secured the services of Mr.

Jacob Snyder, Architect, of Akron, and the First M. E. Church of Akron, Ohio, was the result. In this *the plan of a room adapted to the services of the modern Sunday School first assumed tangible form about 1866.* This should however be considered as a *creation* rather than an *evolution*, as nothing like it — from which it could be developed — existed, or could be found anywhere. *It marked an era and an advance in church or ecclesiastical Architecture such as had not been made for centuries.* So carefully was this plan studied out in all the details of arrangement to meet the existing requirements and anticipate future ones, *that the resultant building still serves as a model,* but little improvement on the general ideas involved having been made since. That a complicated and perfect plan should thus suddenly spring into existence fully developed, — like the birth of Minerva, — without undergoing the slow processes of evolution, seems but little short of the miraculous. An esteemed contemporary thus refers to this plan, "its fundamental principles have never been superseded and never can be" and "is entitled to preëminence in the record." This original plan is indicated by the accompanying cut, Plate A, in which B is the central rotunda, C C, the class rooms; D D, larger rooms for primary classes, J, vestibules; E, library; P, parlor; N, study, etc.; dotted lines indicating balcony and divisions of second floor. As executed however it was combined with a church; being attached to the rear and connecting by the vestibules only, similar to the arrangement indicated by plan No. 2, Plate I, following this chapter: An interior view of a similarly arranged room is shown on page 58, which indicates the arrangement of class rooms in two tiers, the communicating balcony, and the clerestory lighting of rotunda. The necessity of maintaining the Sunday School as an auxiliary of the church and as a part of the church service, suggested the necessity of maintaining the various services in one building, providing departments for the accommodation of each, and for the purpose of accommodating audiences varying in numbers, so locating the rooms and connecting them that they might reinforce each other to their full capacity. This principle of advantage — first suggested by Mr. Miller — soon assumed tangible form and resulted in the now popular "COMBINATION CHURCH."



The AKRON Sunday School PLAN.

Thus originated the Popular "AKRON PLAN" of Sunday School and the "*Akron Combination Church*" now well known wherever modern churches are built. The advantage and utility of these plans soon became widespread; new buildings sprang up all over the country based on these systems, old churches were remodeled wherever possible on these lines, and great activity was displayed in church building on modern lines; all architects and churches adopting to some degree the principles involved, so that the influences of the new departure could be seen everywhere. As evidence that this was not a fad or a sensation, the fact exists that the original principles remain the governing ones, and that all church and Sunday School buildings now being built or planned are influenced more or less thereby. *Church Architecture of America has been completely and permanently revolutionized by this influence.*

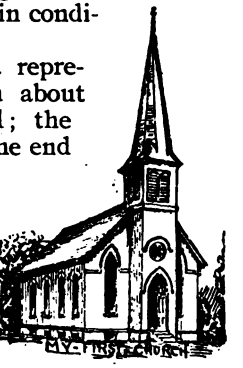


FIRST M E CHURCH AKRON, O.
ORIGINAL OF THE CELEBRATED "AKRON PLAN"

Early in the development of this work, the writer — who had previously been practicing as an architect on similar lines — became associated with Mr. Snyder, and together for several years in that connection they made a specialty of Ecclesiastical work, during which period hundreds of churches and Sunday School buildings were designed and planned, located in all sections of this country, and model or typical plans were sent to the principal centres of Europe, and in at least one instance was the benediction of his Highness, the Pope, received and the building executed for Catholic uses. This connection with Mr. Snyder was continued until a short time previous to his decease, and business then conducted under the name of Kramer & Weary, in which connection a special Ecclesiological department was maintained under the exclusive management of the writer, and the introduction of the systems was pushed in all directions and in new fields with vigor. The demands for service in the East increasing with the popularity of the systems as the public became

familiar with the advantages of same, soon necessitated the removal of this department of office to New York City, which resulted in the withdrawal of the writer from the Akron office and removal to New York, where for the past three years my attention has been almost exclusively devoted to the practice of Ecclesiastical Architecture, giving advantages of location and association which are largely to the benefit of my clientele.

During the period covered by my practice I have planned and designed hundreds of churches, chapels and Sunday School Buildings, located in nearly every state of the Union and many for foreign lands, for all the various denominations, of all capacities, of all degrees of expense and of all classes of material: designs of a few have been introduced throughout this work, and a series of plates prepared, indicating various adaptations of the *plans* and *systems* to certain conditions.



On Plate III, No. 9, will be noticed a representation of the prevailing type of church about thirty years ago, and one still reproduced; the rectangular store box style with tower on one end and an apsidal chancel on the other.

One of the first attempts towards securing a Sunday School building is indicated by B, Plate V; this is only one of hundreds, and similar ones are still being built without the same excuse. With the advent of the Model Sunday School building known as the "*Akron Plan*" and indicated by cut "A" on previous page, came new ideas and increased demands and the "*Combination Church.*"

The first really practical form assumed in applying the *combination* principle to the modern church was similar to No. 18, Plate V, although not so fully developed. This was the result of many experiments which are not indicated. In this plan the Sunday School is located forward of the auditorium; this to some seemed to be giving it undue prominence and detracting from the church-like appearance desirable. To meet these objections the plan indicated as No. 3, Plate I, was developed combining a model church and Sunday School, with the auditorium in front. When not desirable to combine the two the arrangement as indicated by No "2" Plate I, is suggested. The Sunday School department in both being practically the same, the auditorium

when not combining being reversed; in both instances the organ is indicated as being divided, locating the choir between the divided portions thus saving length of auditorium. In Plan No. "3" the space under choir and organ loft is used as a lobby or entrance vestibule, in some instances is used as parlors or choir rooms. The large rose window in front—being directly back of and over the choir is not required for lighting but more for exterior design and is generally made a memorial, when very rich opaque glass can be used, thus making it very ornate and obviating all objections. The strong lights for lighting auditorium are from the opposite sides thus obviating shadows and insuring diffusion.

In some instances on account of limited land or hillside location the erection of a basement or two story church is advisable, for which purpose Plan No. "4" Plate I, was developed, in which the model Sunday School is shown adapted to a basement, the class-rooms being but one story in height with no balcony. The additional tier of class rooms and the balcony connection however can be secured by making the basement story a few feet higher. The main auditorium assuming the cruciform shape is admirably arranged for seating, lighting, entrance, exit and the various requirements, and is provided with a continuous gallery as indicated, the organ being central and choir directly in front. This is an admirable arrangement for a hillside church or even for one on level ground where land is limited, but makes a basement fitted for social work impossible, the Sunday School rooms must be used for this purpose.

To meet some peculiar requirements, early in 1880 we produced the plan shown on Plate III, No. 10, which consisted of an auditorium, combined with eight connecting class rooms in two stories with connecting balcony, the pulpit, choir, organ, etc., being located in a Chancel built on rear corner, and the tower and main vestibule located in the corner diagonally opposite. This arrangement proved very practical and satisfactory and was the *original* of the now popular "*Pulpit in the Corner Church.*" While not arranged on accepted Ecclesiastical lines, the great advantages pertaining to this plan have made it so popular that in some of its forms of development is to-day the foundation of a large proportion of the new churches being built, and is adopted largely by all Architects doing Ecclesiastical work, as it embodies the principle of taking that portion of an audience contained within an angle of 90°—see page 168—and fitting a room to it, including the most advantageous part. The combination

involved, and that nearly every church now erected or contemplated embodies some one or more of these principles variously developed which is a flattering and convincing evidence of the merits of the principles pertaining, and while the systems develop in their most advantageous form in the larger churches, they can be applied as readily and with great profit and advantage to the smaller ones.

Plan No. 7, of Plate II indicates practically the plan of Christ Church, Pittsburgh, the finest church of Methodism; exterior, interior and details of which are shown elsewhere, also indicating a perfect adaptation of the divided organ.

An exterior of Elm Park Church, Scranton, Pa., is also given, a church which has become historic, having been burned twice during erection, when nearly completed, by an incendiary. Also interior of the Baptist Temple, the largest church auditorium of New York or Brooklyn and many other noted churches.

In many instances independent Sunday School Buildings are of advantage wherein it is possible to develop the principles without any hampering conditions. Several different arrangements are indicated by No. 8, Plate II, and C & D, Plate V, No. 8 indicating a Public Library and reading room in connection with the Sunday School. "C" indicates first and second floor plans of a model arrangement in which larger class rooms may be formed by folding partitions where desired, while "D" indicates a building arranged for a different system, which is adapted to a very large school which is to be divided into departments each being a small school in itself; this plan is well worth consideration and study. These plans will all explain themselves, the central portion of each being lighted by means of clerestory windows or a dome.

In connection with the World's Fair in Chicago in '93, a prize was offered in International competition for the best plan for a MODEL SUNDAY SCHOOL BUILDING, to which many were submitted. The plans and designs submitted by the writer in this competition and which were awarded the premium are presented herewith, the building erected however was a composite, being a combination of the principal arrangements and features of several.

On plate VI, also on some of the other plates, plans and designs which do not embody all the more radical modern ideas and are adapted to more orthodox buildings and services are indicated and which sufficiently explain themselves.

With but few exceptions, the plans and designs herewith represent executed work and not imaginative sketches, the principles involved having been tested in practice, all being the work

of the writer; and which represent but a small portion of the work designed or planned during the years of my practice, much of it not even the best, owing to the fact that all drawings, records and plans of work executed prior to 1886, were destroyed in the burning of our offices in that year.

Considering the fact that nearly every feature of value pertaining to the systems originated with me, in the offices with which I have been connected or were developed by our efforts in connection with those whose practical knowledge of the requirements and essentials rendered their suggestions and advice of especial value, and to whom due credit should be given, I feel justified in the statement that a resumé of my experience and

that of my predecessor is practically a history of the development of the modern church as it exists to-day.

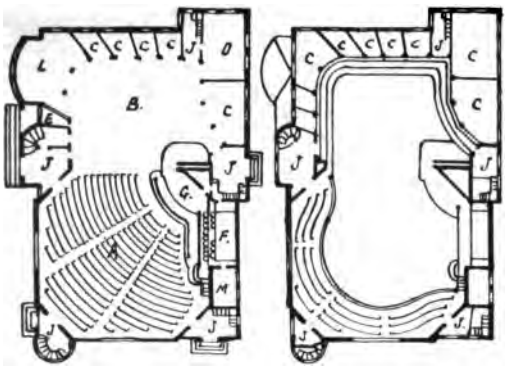
A partial list of churches for which I have served as Architect made from preserved records and memory indicates the following distribution and denominational character varying in expense from $3,000 to $300,000 — Alabama 2, Arizona 1, Connecticut 5, Colorado 2, California 5, Florida 1, Georgia 2, Indiana 15, Illinois 17, Iowa 12, Kentucky 5, Kansas 2, Massachusetts 3, Maryland 2, Missouri 5, Michigan 8, Minnesota 6, Montana 1, New York 20, New Jersey 6, North Carolina 1, Nebraska 3, Ohio 57, Oregon 1, Pennsylvania 19, South D

Texas 1, Tennessee 6, Vermont 2, Virginia 2, Wisconsin 2, Washington 1, Honolulu 1, New Zealand 1—and for the following denominations: M. E. north 122, M. E. south 3, Congregational 13, Presbyterian 19, Lutheran 8, Baptist 10, Christian or

FIRST M. E. CHURCH OF NORTH NEW YORK, N. Y.
GEO. W. KRAMER, ARCHITECT.

Disciple 18, Catholic 3, Swedish 2. This list however embraces less than half of those with which I have been connected as Architect in the past twenty years.

TYPICAL PLANS



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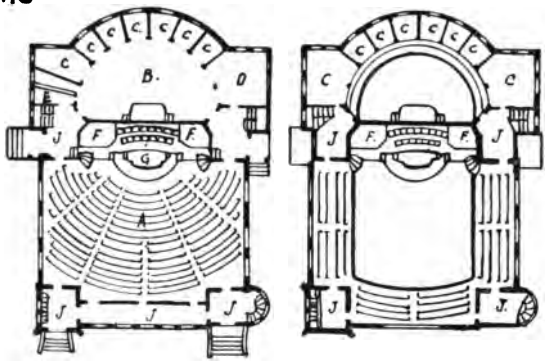

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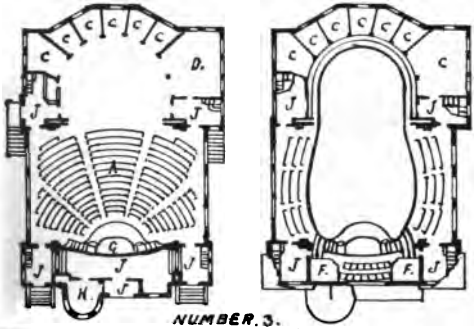

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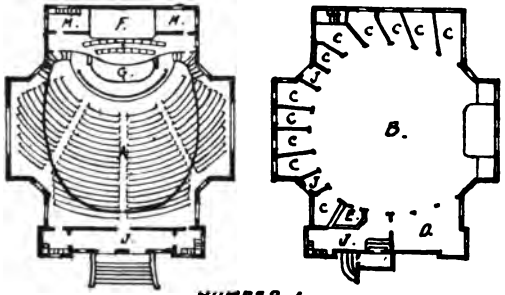

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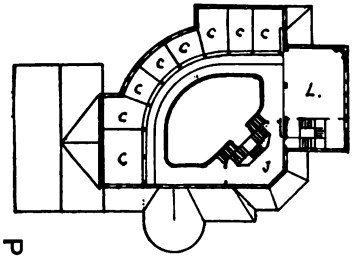
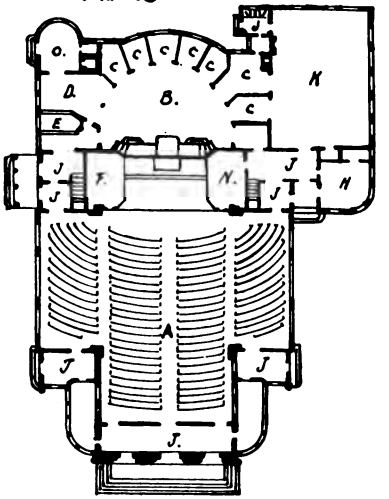
PLATE I

TYPICAL PLANS

PLATE 2





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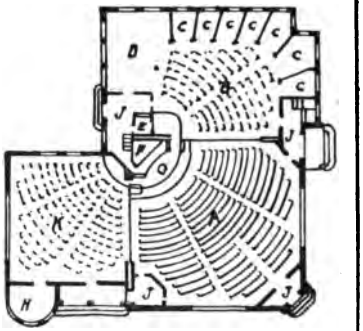

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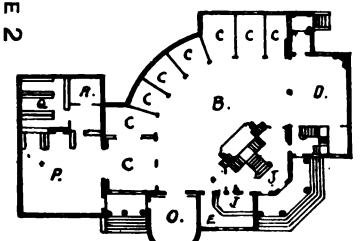
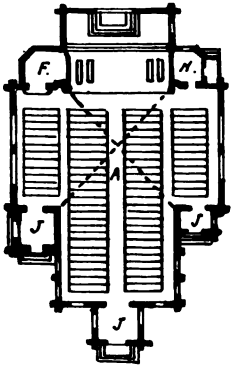


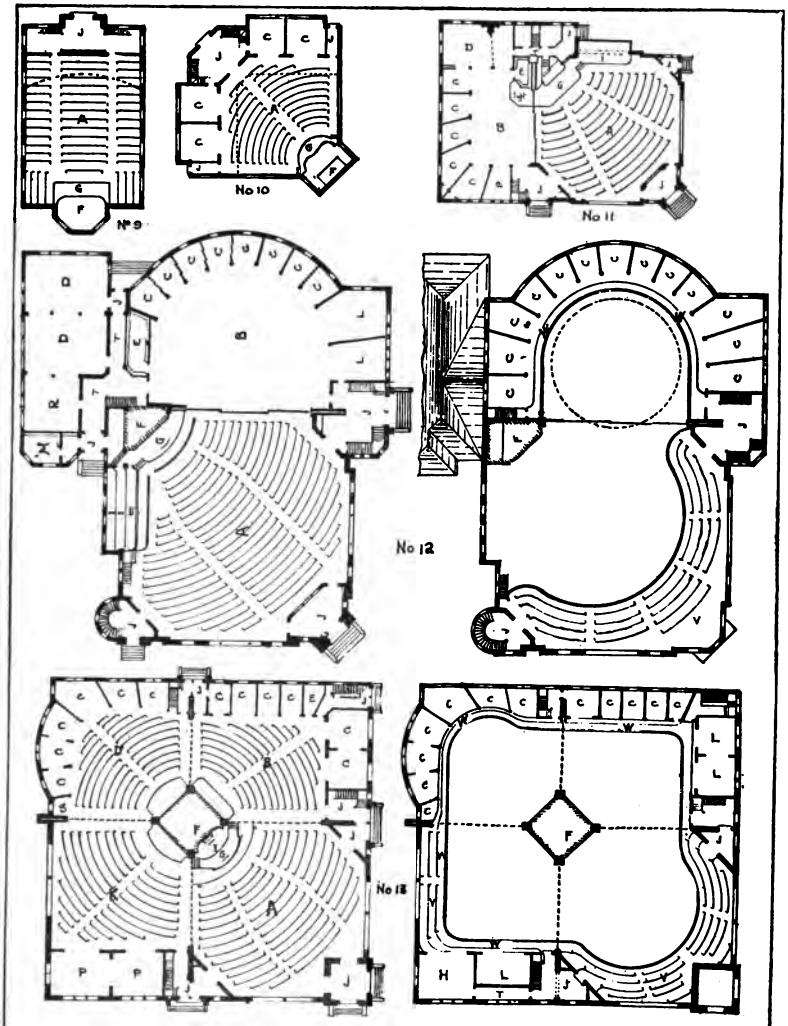
NUMBER 8.. MODEL S.S. BUILDING.



NUMBER 5.

A.. MAIN AUDITORIUM
B.. S.S. " "
C.. CLASS ROOMS.
D.. PRIMARY CLASS
E.. LIBRARY.
F.. ORGAN.
N.. VESTRY.
G.. PULPIT PLATFORM.
H.. STUDY.
J.. VESTIBULE
K.. CHAPEL
L.. LEAGUE OR SOCIETY ROOMS.
M.. ANTE ROOMS.
O.. OFFICE.

P.. READING ROOM.
Q.. STACK "
R.. LIBRARY OFFICE.



A	Main Auditorium	I	Choir or Orchestra	S	Secretary.
B	S S -	J	Vestibule	T	Corridor or Passage
C	Class Rooms	K	Lecture Room or Chapel	U	Altar
D	Primary Dept.	L	Society Rooms	V	Gallery
E	Library	N	Vestry	W	Balcony
F	Organ	O	Office		
G	Pulpit Platform	P	Parlor		
H	Ministers Study	R	Kindergarten		

PLATE 3

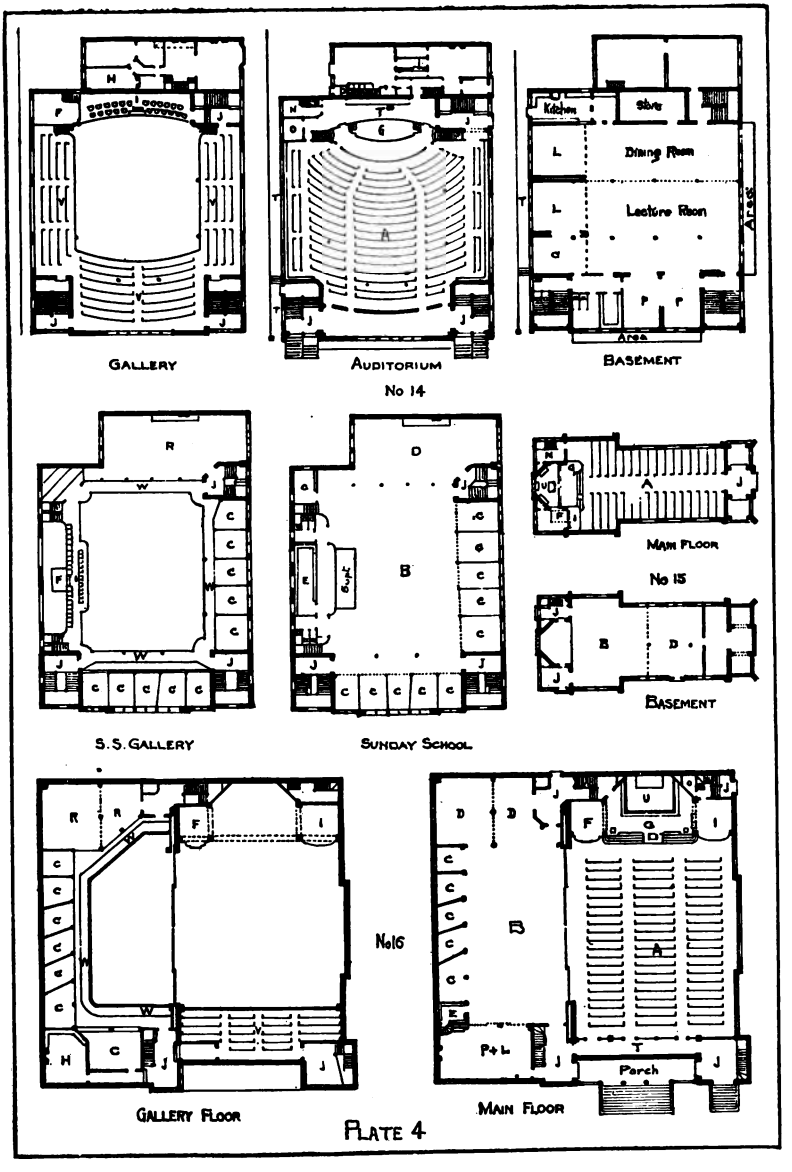

Kitchen
store
Dining Room
Lecture Room
Area
Area
GALLERY
AUDITORIUM
BASEMENT
No 14
MAIN FLOOR
No 15
BASEMENT
S.S. GALLERY
SUNDAY SCHOOL
No16
GALLERY FLOOR
MAIN FLOOR
Porch

PLATE 4

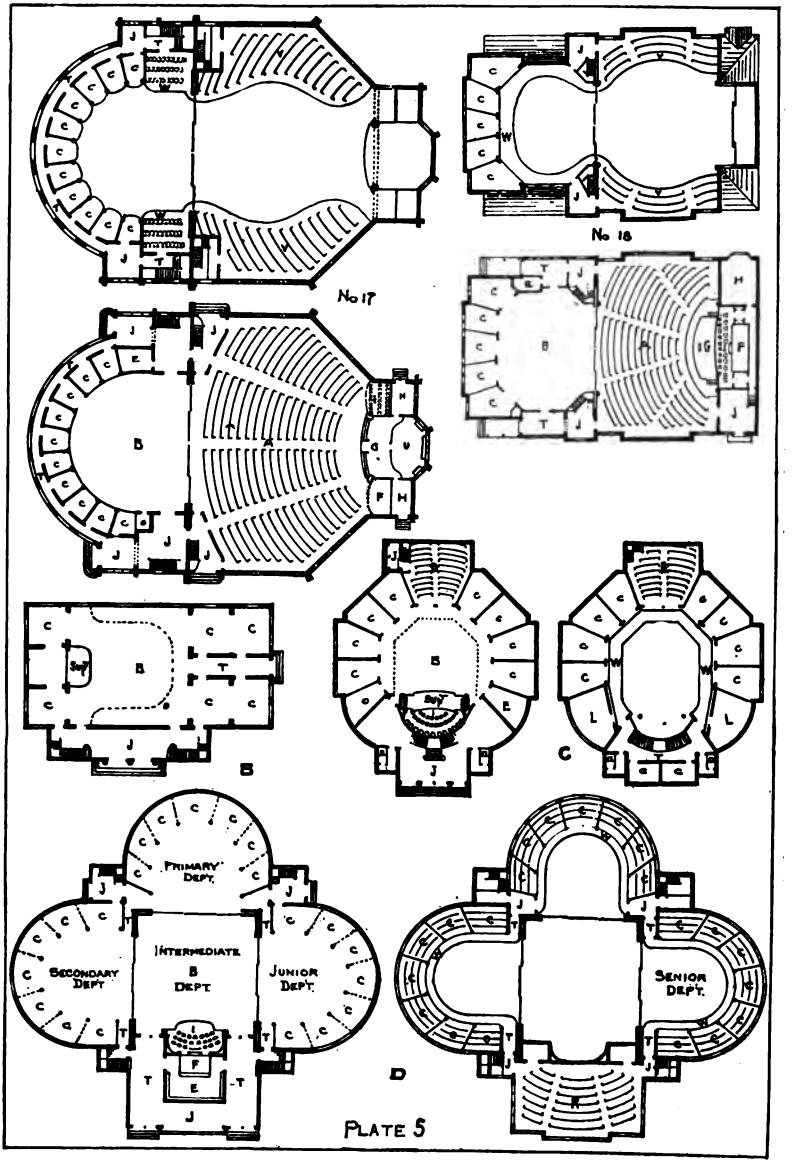

No 17
No 18
B
C
D
PRIMARY DEPT.
INTERMEDIATE
B
DEPT.
SECONDARY DEPT
JUNIOR DEPT.
SENIOR DEPT.

PLATE 5

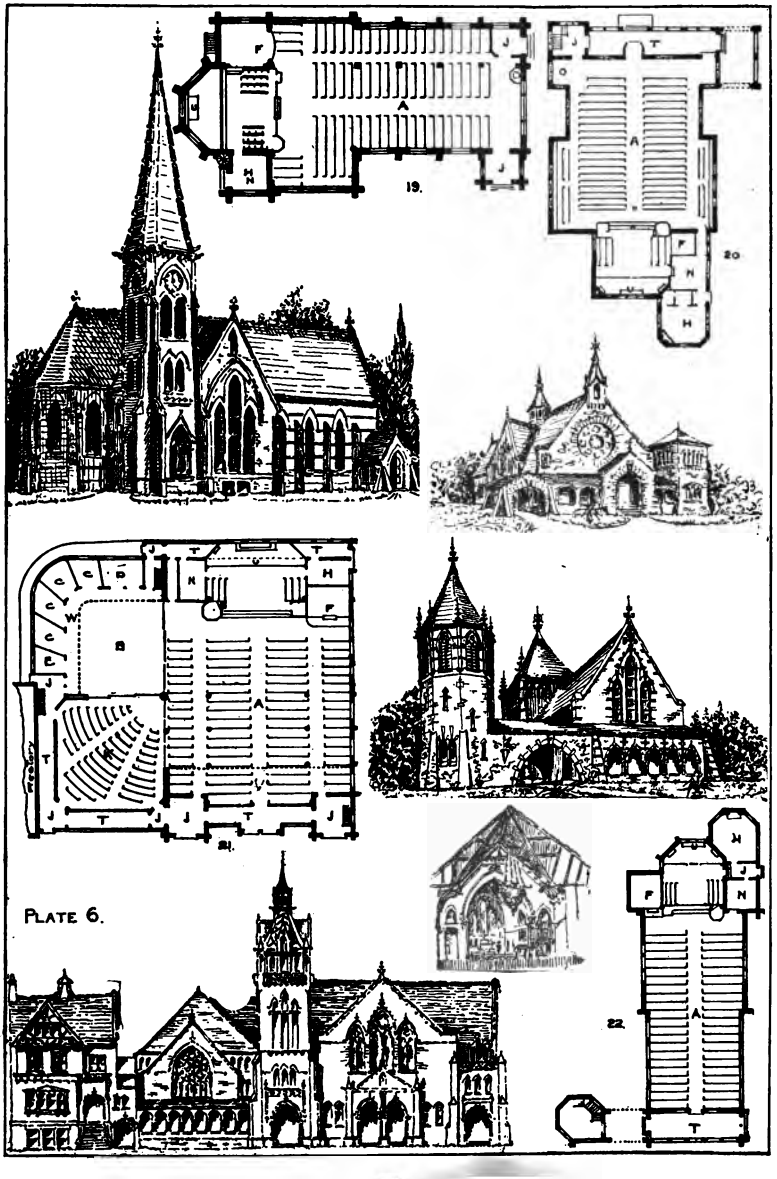
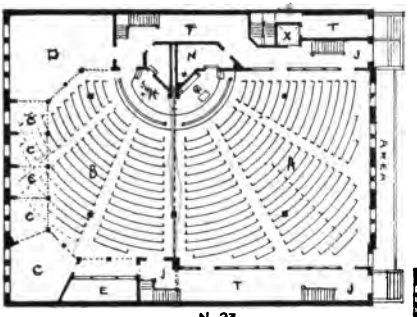


PLATE 6.



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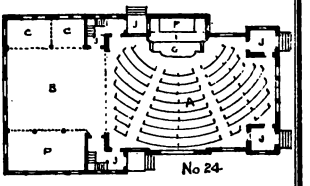

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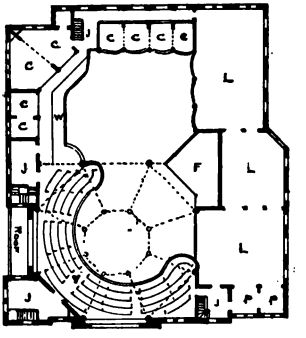

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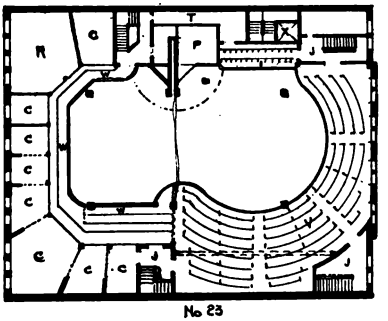

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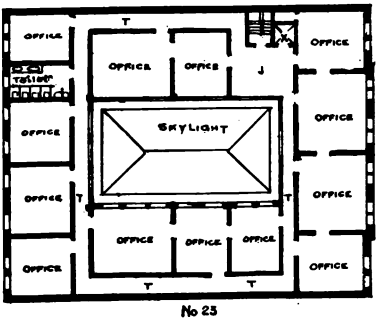

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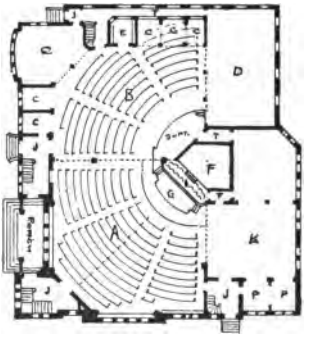

X Elevator

PLATE 7

CHAPTER XVII.

TECHNICAL.

BACK of the Architectural effects which are largely artistic and esthetic, and which mark the *Artist's* skill, lies a sphere in which the *Engineer* and the *Specialist* are taxed to meet the developments of modern necessities.

Constant application, practice and experience are essential to keep pace with the rapid development or evolution of improvements, and the best results in this or any other matter can only be obtained by securing the services of skilled specialists in the several departments.

Proficiency, combined with intelligence and ingenuity, controlled by that healthy competition which more or less affects every business, secures such economic results that considered as to quality and character, the best will always be found to be the cheapest.

It is always considered good business policy to "*Spend a Shilling to save a Pound.*" When contemplating the erection of a new church, the committee in charge should study the interest of the Society, not only in ascertaining what will be to their interest or greatest advantage in the way of plan or arrangement, but also to secure substantial and economical results. No one is better qualified than the specialist to produce such results. In securing the services of a specialist, however, be sure he is what he represents himself, whether a Minister, an Attorney, a Physician, an Engineer, an Architect, an Artist or an Artisan; bearing in mind this fact, *that making a special study of any subject without corresponding practical experience does not make a specialist:* That in addition successful satisfactory results are essential. Experience cannot be inherited or purchased but must be acquired by practice.

In anticipation of many inquiries as to where services or articles of special character are to be obtained, a limited number of representative specialists have been permitted to present their claims for recognition and patronage in this connection, and in each instance are parties who we can recommend.

In the *early stages* of the enterprise, the advice of a competent, experienced, trustworthy Architect should be secured; parties who struggle along with all the preliminary work, and later employ their Architect, do not secure full services. The real valuable work and often of vital importance is that rendered during the embryotic period, often of a critical nature, and on which the success of the whole enterprise depends, full architectural services rendered by a competent man will save many times the comparatively small compensation; but "there are Architects and Architects" and the fact that any one has successfully designed and carried out a school house, a factory, a brewery, a barn or a hundred buildings of any class does not qualify him to plan or design a church. What is there in common?

It is not always necessary to build a *new* church. Many congregations possess buildings too good to abandon, and which in the hands of a competent, ingenious Architect may be remodelled so as to possess all or nearly all of the advantages of a new building at much less expense. Many new buildings have been erected without proper consideration, which are too late found to be so illy adapted to the services as to be an actual hindrance.

It has not been the purpose of this work to exhaustively consider the subject, and it is anticipated that many may desire further information. To any or all such we would tender our professional services. Our claims and experience as a specialist have been set forth in a preceding chapter; the list given will indicate that during the period of our practice we have possibly designed and planned more churches and for more localities than any other Architect in a corresponding period of time or possibly any period, and does not include any on which services were rendered as consulting or Associate Architect.

On application, blank forms will be furnished, which when properly filled out will convey all information and data necessary in preparing preliminary plans or studies.

GEO. W. KRAMER,

Fellow of the American Institute of Architects,
Heating, Ventilating and Acoustical Engineer.

Address all communications
GEO. W. KRAMER,
No. 1 Madison Ave.,
New York City.

In closing we desire to acknowledge the courtesy of Messrs. J. & R. Lamb for the use of the several small cuts herein, representing stained-glass windows, decorative panels and special furniture.

STAINED GLASS WINDOWS:

We are Art Workers whose specialty is CHURCH and MEMORIAL work.

We execute all forms of Stained Glass from the simplest geometric designs to the most elaborate figure windows.

To the Clergy and Church Building Committees, as well as individual Memorialists, a cordial invitation is extended to visit our new large STUDIOS,

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Send for new illustrated Hand-Book on Stained Glass and Color Decoration. : : : : : :

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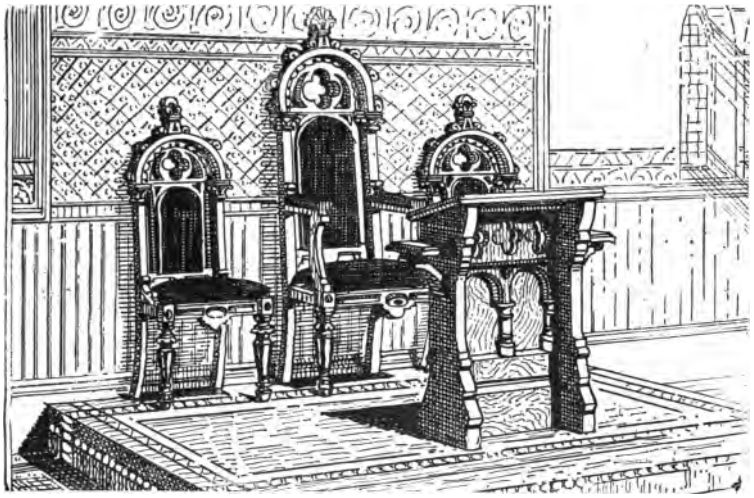

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Correspondence solicited with Church Building Committees in advance, so that special suggestions may be made for those parts which affect the artistic result of the Church Interior.

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BRANCH OFFICES:

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CHRIST CHURCH, PITTSBURG, PA.

Important

The cut on opposite page shows a view of my "**PATENT TRUE CURVE CIRCULAR PEW-BACK,**" which for comfort, strength and elegance has no equal. It is constructed of three veneers of any material required, each veneer being one quarter of an inch thick, all three of which are cemented together and forced into shape by powerful presses, and the glue allowed to dry under pressure, rendering it impossible for this pew-back to warp, check or split. It has a true curve from top to bottom, which is combined with a circle whose radius is any that may be required in a church, and can be used with any designed pew end.

By continually adopting all the latest improved machinery, carrying a large stock of seasoned material on hand, purchased in large quantities, and employing the very best of skilled labor, enables me to furnish work that is guaranteed **FIRST-CLASS** in every respect.

A pamphlet of references, showing where this article has been used by the different churches, gladly furnished upon application.

Correspondence solicited, which will receive prompt attention.

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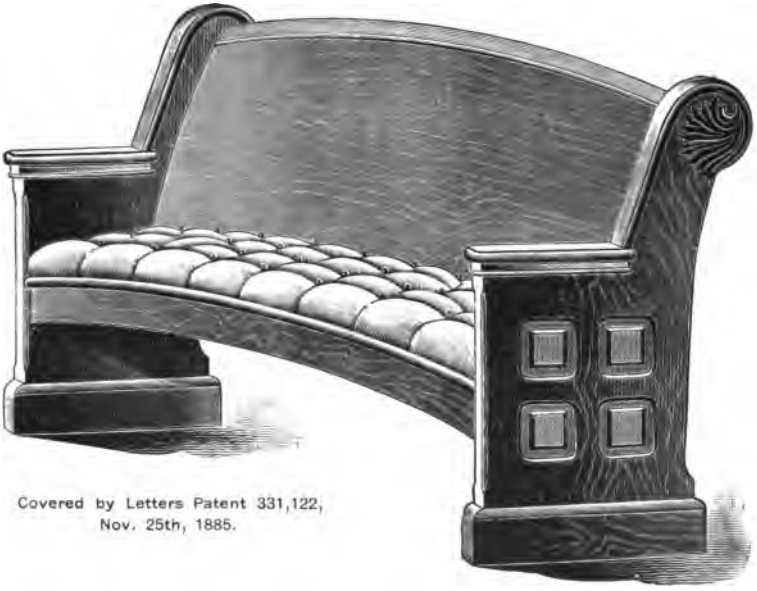
Manufacturer of

Church Furniture,

380 Scranton Ave., CLEVELAND, Ohio.

CHURCH FURNITURE.



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Nov. 25th, 1885.

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CORDED EDGE CUSHION, IMPERIAL BORDER, CORDUROY PLUSH COVERING.

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TURKISH CUSHION, DOUBLE ROLLED EDGE, CORDUROY PLUSH.

Made for St. Bartholomew's, Madison Ave. and 42d St., and Grace Church, Broadway and 10th St., New York City, exhibiting the very highest class of work of superior excellence; covering all in one piece, unbroken by seams or cords.

SPECIAL TRADE-MARKS.

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* "All Cushion work exclusively with "hand-laid fillings" in layers and sheets; no machine filling; no "stuffing." * Exclusive Manufacturers.

JEFFERSON AVE. PRES. CHURCH, DETROIT, Mich., Nov. 4, '85.

MESSRS. OSTERMOOR & CO.

Dear Sirs: The Jefferson Ave. Presbyterian Church, of Detroit, in the year 1855, placed in the pews of their church edifice the Patent Elastic Felt Cushions, which have been in constant use ever since (30 years), and they have certainly given entire satisfaction. Have no doubt they will do good service for 20 years more.

Respectfully yours,
ELISHA TAYLOR,
B. WRIGHT,
F. WETMORE,
Special Trustees.

PLYMOUTH CONGREG'L CHURCH, ROCHESTER, N. Y., Sept. 27, 1890.

MESSRS. OSTERMOOR & CO.

Gentlemen: Your Patent Elastic Felt Cushions were put in our church in 1855, were simply recovered by you in 1877, and now appear to be in good condition. Thirty-five years of use, and good for as many more, judging from present appearance.

Yours truly,
MYRON ADAMS,
Pastor.

OSTERMOOR & CO., 116 Elizabeth St., New York City.

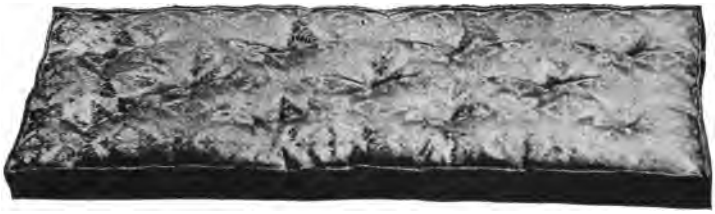
Cushions

Are a most important church factor, not only for comfort, but enter most markedly into the color scheme of decoration, and if well-made, greatly enhance the interior of the edifice by their lines and beauty, if they display an *art* in building such as has been made an exclusive study by OSTERMOOR & Co. since 1853, during which time they have furnished over 25,000 churches.

They have a most wonderful filling in their Patent Elastic Felt, which they absolutely guarantee not to mat or pack, and to be moth-proof as well, these being the special points of weakness in all other Cushion fillings, especially the best curled hair.

The Corduroy Plush, an original and exclusive fabric for covering, most marvelously moth-proof, as well as of exquisite texture and beautiful finish, is unequalled.

The incomparable qualities of endurance and standing "the test of time" possessed by these Cushions being most fully proven by the prodigious amount of unsolicited testimonials OSTERMOOR & Co. have received. A big list of these testimonials and descriptive circular can be secured, postage free, by addressing, **OSTERMOOR & CO.,**
116 Elizabeth Street, New York.



CUSHION MADE BY OSTERMOOR & CO. FORTY-FOUR YEARS AGO, PHOTOGRAPHED AFTER CONTINUOUS USE DURING THIS PERIOD IN CALVARY BAPTIST CHURCH, N. Y. CITY.

CALVARY BAPTIST CHURCH,
NEW YORK, Feb. 6, 1894.

MESSRS. OSTERMOOR & Co.

Dear Sirs: It gives me much pleasure to say that the Patent Elastic Felt Cushions put by your Company into the Calvary Baptist Church more than FORTY YEARS AGO ARE STILL IN EXCELLENT CONDITION, and I can most heartily recommend them. They still retain their elasticity, and are free from moth and vermin of every sort.

They have preserved their shape better, and are, in my judgment, in every way more desirable than Cushions made of any other material offered to the public.

The Cushions were put in the church long before I became a preacher. Of their present condition I can judge. In regard to the length of time they have been in use and the satisfaction they have universally given, the officers of the church are my authority.

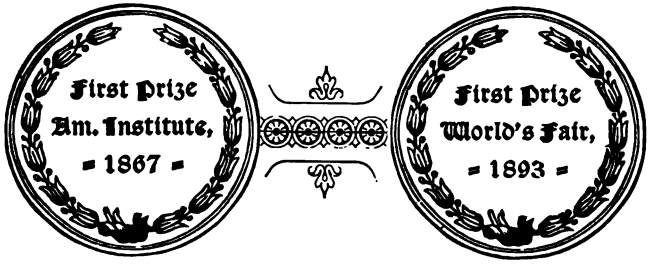
We found the Cushions, after so many years' constant use, in such good condition, that upon going into our new church we had you recover them, and they are to-day certainly AS GOOD AS NEW. Very respectfully,

R. S. MACARTHUR, D. D., *Pastor.*

OSTERMOOR & CO.,

116 Elizabeth Street, New York City.

I. P. FRINK



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We never have competed with cheap makers of cheap goods at cheap prices.

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Cheap Reflectors are never cheap in the end.

The best Reflector lasts longer, looks better, and costs less to run because it is a better distributor of light.

Our Reflectors are always made on angles best suited to the room for which they are required.

The earlier your plans are made for the Lighting of your Church or Building, the less it may cost you, and the handsomer your interior will be.

The fixtures should harmonize with the finishings. Delay may mean lack of harmony and more expense.

In the harmony of lighting with the building itself is the beauty of the whole.

Early orders for fixtures gives us better opportunity to satisfy you, and allow freight shipments which mean a saving in expense.

Understand, we take all risk of breakage in transportation and guarantee absolute satisfaction when size of room is given us and Reflectors are ordered according to our recommendations.

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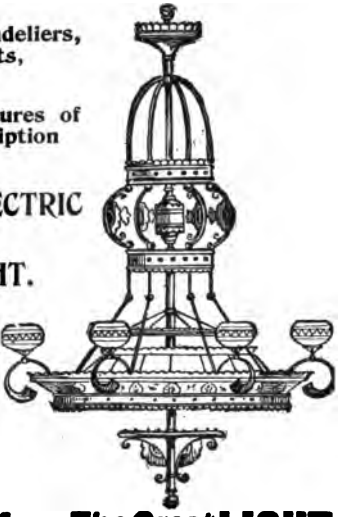

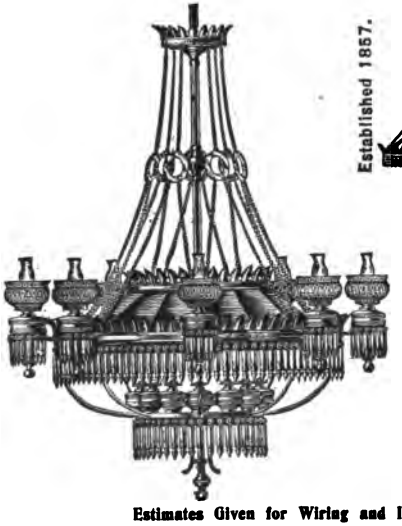

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Estimates Given for Wiring and Installing the Fixtures Complete.

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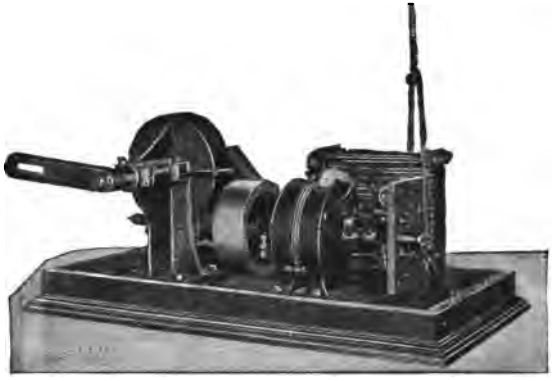

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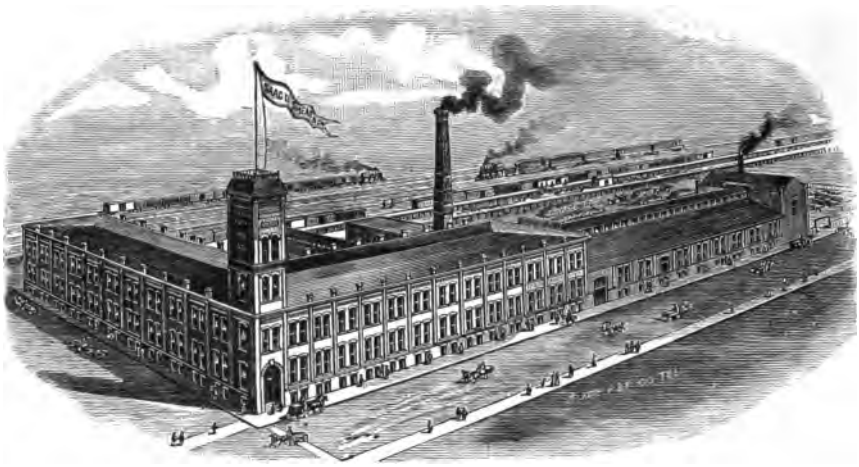

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For 29 Years.

== Testimonials ==

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Previous to closing contract to provide Heating and Ventilating Apparatus for the new Ashland Avenue Baptist Church — a building costing over $40,000 and containing over 200,000 cubic feet of space to be warmed — our committee made a *very careful* investigation of the several systems presented for our consideration, and finally and without prejudice in favor of Smead over others, selected the Smead System, notwithstanding the fact that his was by no means the lowest bid tendered. That the action of our committee was wise is evidenced by the fact that the Apparatus has from first to last given *entire satisfaction* to all. It has been in almost constant use since last Fall, and it has never cost any one a cent for repairs; and, so far as we can judge, is in as good condition to-day as when placed in position. The contract was executed in a most thorough and workmanlike manner, Colonel Smead doing *more* than he agreed to do; the Apparatus in all particulars being better than he represented. Our Dining-Room in the basement is 70 feet long, 25 feet wide and 10 feet high, and can be warmed to 70 degrees in *five minutes*, regardless of temperature outside, a very unusual result. Our Janitor is by no means skilled in mechanical matters. We are entirely familiar with the Apparatus, and believe that there is practically no loss of fuel; and, as evidence of the low temperature of the smoke-pipe, we call attention to the fact that it is not sufficiently hot to burn the hand when placed on it with two thicknesses of a handkerchief intervening, and this with a half-ton of coal burning in the furnaces. (Signed)

EMORY W. HUNT, Pastor.
CHAS. T. LEWIS, Chairman.
JULIUS G. LAMSON.

For further information, address

THE SMEAD FURNACE AND FOUNDRY CO.,

TOLEDO, O.

MARSHALLTOWN, Iowa, March 21st, 1895.

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MY DEAR SIR: The Smead System is meeting the demands of our large church, and I think will prove the most satisfactory of anything that we could have used. We have tried it in both cold and moderate weather, and find it suited to either. The fan will come to be indispensable in all public buildings. It furnishes pure air, gives power to heat any part of our building regardless of winds, economizes fuel, and marvelously expedites the warming of the house. I am especially appreciative of your promptness and cheerfulness in giving attention to minor details we have thought needful to the highest perfection in the adaptation of the system to our church.

Very truly yours,

JULIUS A. WARD,
Pastor First M. E. Church.

COLOGNE, Minn., Feb. 12th, 1895.

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GENTLEMEN: I am well pleased with your furnace. It works to perfection. I do not think it can be surpassed by any other in the world.

Yours, JOHN SEABERT,
Catholic Priest.

The Smead System of Warming and Ventilation

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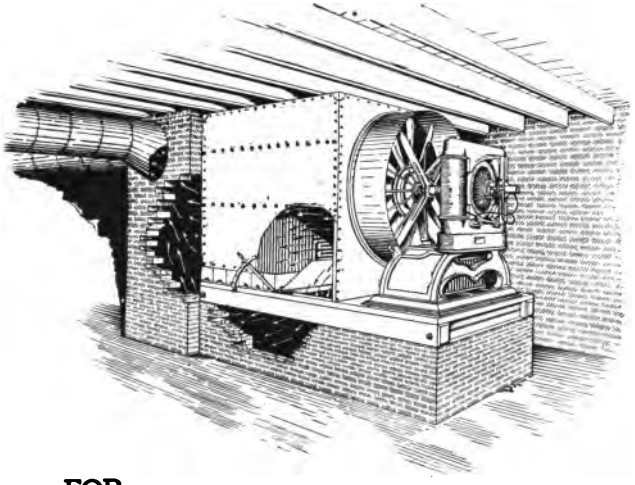
Des Moines, - - - Iowa.

The A B C Fan System of Heating and Ventilation.



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BY ALL THE APPROVED, UP-TO-DATE METHODS . .

Steam, Hot Water, Furnace and Fan Systems.

A KNOWLEDGE of what is best in methods, combined with the use of what is best in apparatus, enables us to advise Church Committees intelligently, and facilitate their work in selecting a system.

Ability to plan a successful interworking system of Heating and Ventilation for large buildings is not common, and our long experience and favorable record in Church and School work, is our excuse for emphasizing this phase of the subject.

Our engineers are at the service of committees in arranging preliminaries, without imposing any obligation to purchase of us.

The only preference we ask is that of merit — merit in the conception and elaboration of a suitable plan, and merit in the apparatus used. There is so much haphazard work done in connection with Church Heating and Ventilation, that the assurance of an intelligent conception of what is necessary on the part of the contractor, and a guarantee of satisfactory results, will be appreciated by committees having this work in charge.

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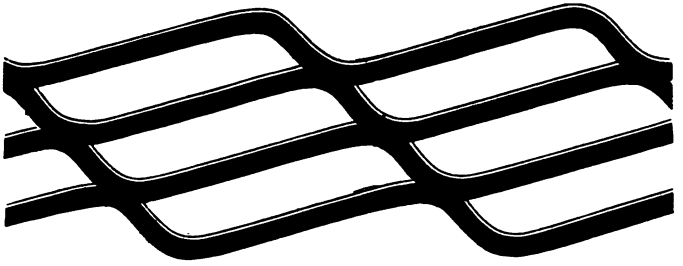

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"The proofs of its endurance are abundant, for the walls of houses built of this stone during the last century manifest no indication of erosion or decay; *in this respect it is superior to marble."—Pennsylvania Geological Survey, Chester County*, page 346.

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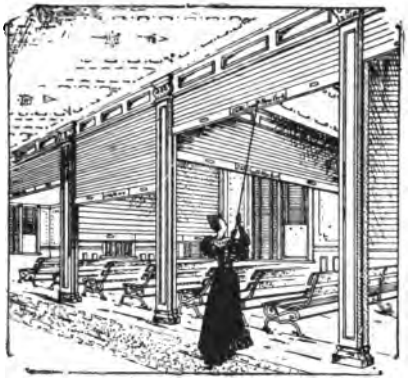

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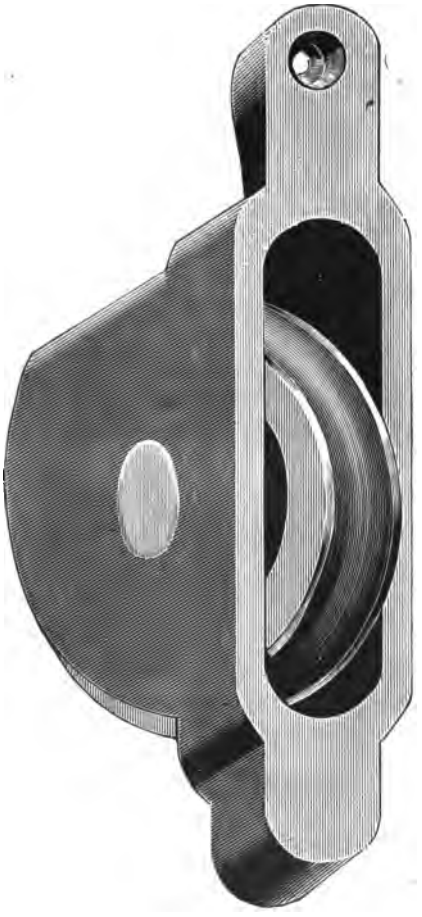

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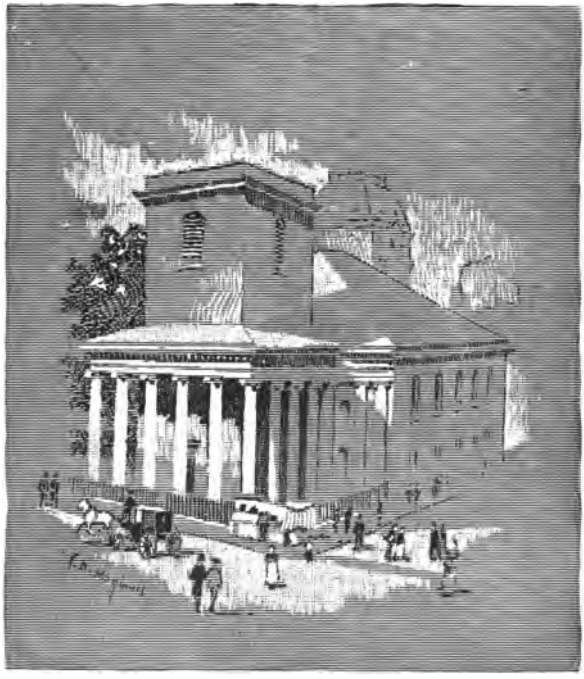

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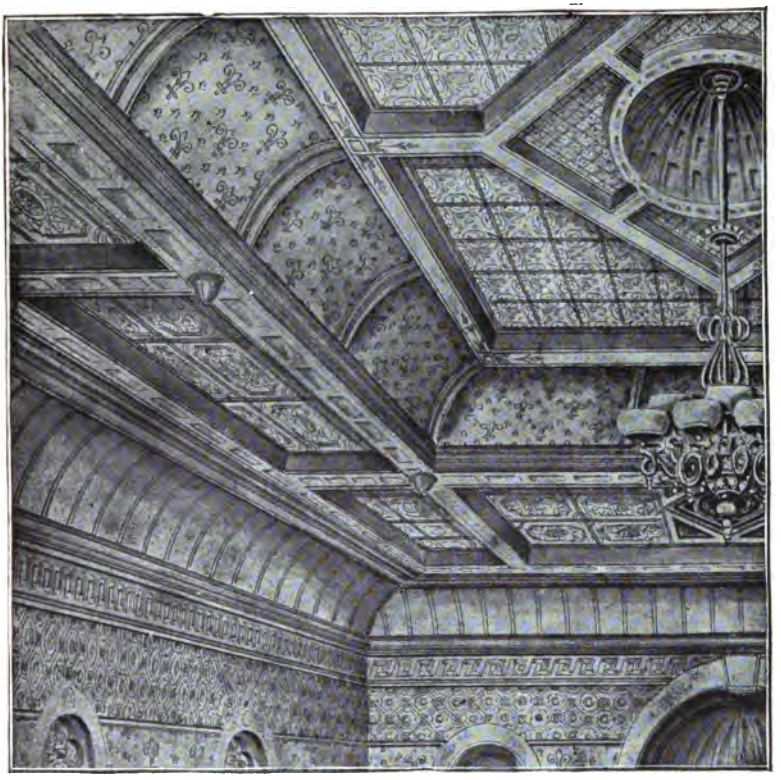

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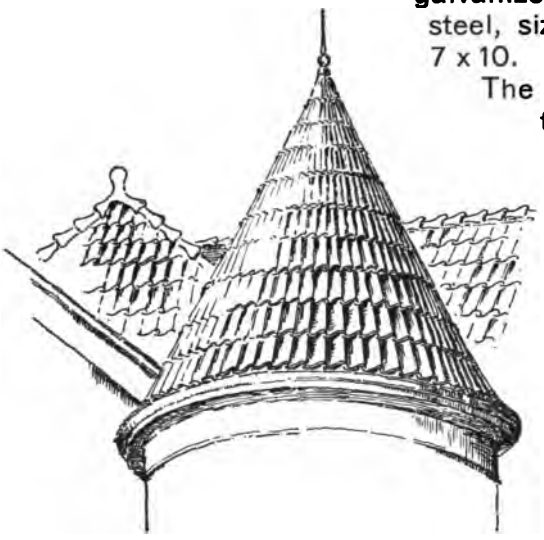

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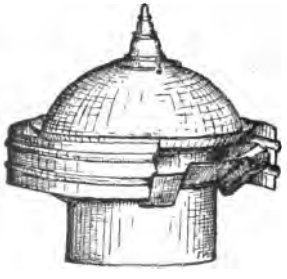

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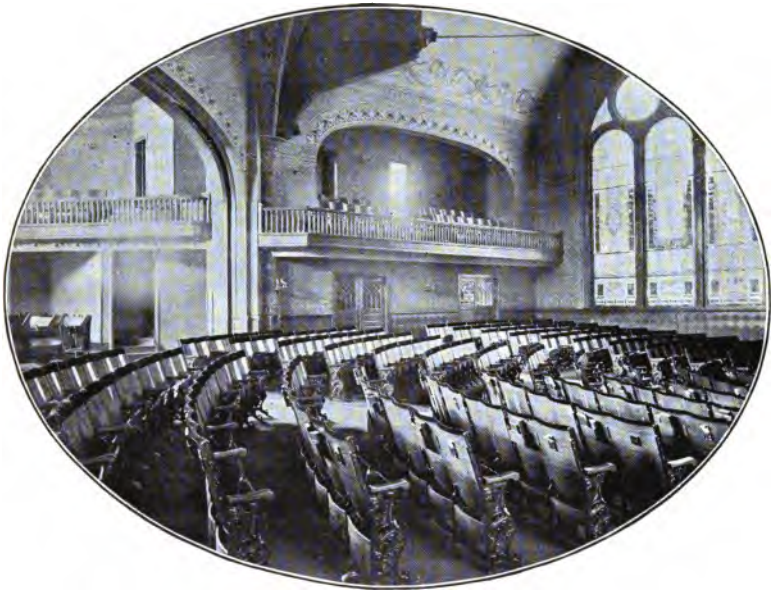

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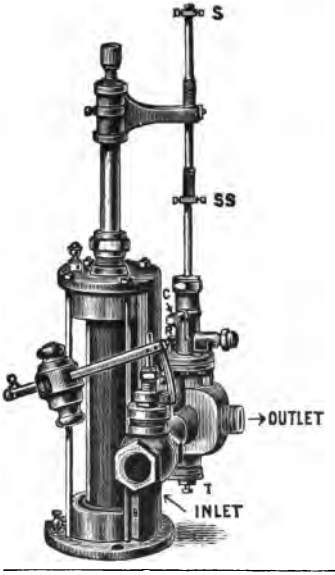

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Kramer, George W., 1847-
The what, how and why of church building / Geo W. Kramer. -- New York : s.n., 1897.
234 p. : ill., plans ; 21 cm.

1. Church architecture--Designs and plans. 2. Churches--History--19th century. I. Title

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